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# ENVIRONMENTAL ASSESSMENT BOARD



## ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARINGS

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VOLUME: 139

DATE: Tuesday, April 28, 1992

BEFORE:


HON. MR. JUSTICE E. SAUNDERS	Chairman
DR. G. CONNELL	Member
MS. G. PATTERSON	Member

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ENVIRONMENTAL ASSESSMENT BOARD  
ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARING

IN THE MATTER OF the Environmental Assessment Act,  
R.S.O. 1980, c. 140, as amended, and Regulations  
thereunder;

AND IN THE MATTER OF an undertaking by Ontario Hydro  
consisting of a program in respect of activities  
associated with meeting future electricity  
requirements in Ontario.

Held on the 5th Floor, 2200  
Yonge Street, Toronto, Ontario,  
Tuesday, the 28th day of April,  
1992, commencing at 10:00 a.m.

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VOLUME 139  
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B E F O R E :

THE HON. MR. JUSTICE E. SAUNDERS	Chairman
DR. G. CONNELL	Member
MS. G. PATTERSON	Member

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Addition to Exhibit 632:

	Letter from the AECB addressed to Ms. Kock, dated 22nd of April, 1992, indicating that the request for funding for studies was made to the AECB on April 2nd, and the board did approve \$400,000 funding for that project.	24363
647	Document entitled: Miscellaneous References for IPPSO's Cross-Examination of Ontario Hydro Witness Panel 9.	24414
648	Document entitled: State of the World Report, 1992 Article Entitled Confronting Nuclear Waste.	24414
649	Update and Revision to 9.7.111.	24475
650	The Cost of Nuclear Plant Capital Modifications, A Statistical Analysis.	24476
520.125	Interrogatory No. 9.2.25.	24495
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L I S T o f U N D E R T A K I N G S

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532.13	Ontario Hydro undertakes to provide six-year projection for outages for inspections and any patching necessary based on past experience pending the large scale fluid channel replacement.	24528





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1       ---Upon commencing at 10:03 a.m.

2               THE REGISTRAR: Please come to order.

3       This hearing is now in session. Please be seated.

4               Mr. Poch?

5               MR. D. POCH: Good morning, Mr. Chairman.

6               Mr. Chairman, at transcript page 23969 of  
7       Volume 136, I introduced Exhibit 632, which you may  
8       recall was what appeared to be an AECB staff document  
9       presented to the Board with respect to the request for  
10      funding for studies of seismic-related geologic  
11      features. Mr. Penn on the following page expressed  
12      some concern that it didn't appear as a typical AECB  
13      format to him and I promised I would get further  
14      information. I did since that time provide the board  
15      agenda which made mention of it, and we have now  
16      received, from the AECB, a letter which I have provided  
17      to Hydro and to Mr. Lucas which I think should be made  
18      an exhibit.

19              Briefly, it's a letter from the AECB  
20      addressed to Ms. Kock, dated 22nd of this month,  
21      indicating that indeed the request for funding for  
22      those studies was made to the board, the AECB on April  
23      2nd, and the board did in fact approve \$400,000 funding  
24      for that project.

25              THE CHAIRMAN: Well, this material should

1       be perhaps attached to 632. That would be a better way  
2       of perhaps of dealing with it, so it's there.

3               MR. D. POCH: That's perfect. Thank you  
4       Mr. Chairman.

5               THE CHAIRMAN: Would that be  
6       satisfactory, Mr. Campbell?

7               MR. B. CAMPBELL: That is fine.

8               Mr. Chairman, if I might, there is one  
9       thing that I would like to mention now, more for the  
10      purpose of people who are reading the transcript, other  
11      parties that are reading the transcript, it's an easy  
12      way to communicate with everybody.

13              I gather there has been some change in  
14      the order of cross-examination, we had not expected  
15      IPPSO to started today, and there has been quite a  
16      scramble to try and get materials together and so on.

17              I would just like to record, so people  
18      who are reading the transcript can do this, if people  
19      would let us know when that has happened it would be  
20      appreciated, because we just assume as the list has  
21      been set out at the beginning, that unless we hear  
22      something differently, that's how it's going to  
23      proceed.

24              So for the purposes of communication, we  
25      will make a more regular habit at this point of



1       contacting Board staff as well.

2               THE CHAIRMAN: I think that's the way to  
3       do it. There is a certain volatility that has to  
4       inevitably be part of the process, and the best way is  
5       to communicate through Ms. Morrison and Mr. Nunn.

6               MR. B. CAMPBELL: I have asked this  
7       morning, and I expect we will be putting in place that  
8       we will initiate contact with Board staff on a regular  
9       basis, but if people could let us know that would be  
10      appreciated as well.

11              THE CHAIRMAN: All right.

12              Mr. Greenspoon?

13              MR. GREENSPOON: Thank you, Mr. Chairman.

14              DAVID WHILLANS,  
15              KURT JOHANSEN,  
16              FRANK CALVIN KING,  
              WILLIAM JOHN PENN,  
              IAN NICHOL DALY; Resumed.

17      CROSS-EXAMINATION BY MR. GREENSPOON (Cont'd):

18              Q. Just one matter before I start on the  
19      next topic, I wanted to go to page 35 of Exhibit 645  
20      which is the final report of the Select Committee on  
21      mining, milling and refining.

22              Dr. Whillans, page 35 is an exhibit, 3.1,  
23      I guess, to this Select Committee document. What it  
24      is, it's titled Simplified Decay Chains of Three  
25      Thorium Isotopes.

1 Dr. Connell had asked about radon being a  
2 Noble gas. Dr. Whillans, do you recall that question?

3 DR. WHILLANS: A. Yes, I do.

4 Q. And, in fact, it is a Noble gas.

5 I just wanted to confirm, in the middle  
6 decay chain, thorium-232 where radon is shown, Ra,  
7 that's radon?

8 A. No, Ra is radium.

9 Q. Rn is radon. And likewise in the  
10 thorium-231, Rn, do you see that?

11 A. Yes, 219.

12 Q. And likewise in thorium-234?

13 A. Yes.

14 Q. Rn. And that's the 3.8 days that we  
15 talked about?

16 A. Yes. Actually the thorium-234 chain  
17 is usually called the uranium series. It starts with  
18 uranium-238 and works it's way down to uranium-234.

19 Q. Would it be fair to say that it is,  
20 in fact, from a radiological and from a health impact  
21 and impact on the environment, it's the daughters of  
22 radon that is of concern to people?

23 A. Once the radon is available, that is  
24 it's into say room air or in the body, it's the  
25 daughters that provide most of the harm, yes. The

1 radon is important because that's the way it gets out  
2 of the soil.

3 Q. As you agreed to in evidence  
4 yesterday, the thorium which was going to be around for  
5 80,000 years, would only produce half of its radon  
6 during that time?

7 A. The half life of thorium-230 as shown  
8 here is 80,000 years.

9 Q. Now, I wanted to go back to the North  
10 Channel. I think your counsel Ms. Harvie and somebody  
11 else indicated we were talking the notice provision,  
12 and I didn't pull it out at the time, but there was  
13 some -- I had indicated that it was my understanding  
14 that the area from Sault Ste. Marie to Espanola, south  
15 to Manitoulin Island that was marked on the notice map  
16 was the site for the North Channel, and Ms. Harvie  
17 indicated that she thought it was the study area.

18 Just looking at the notice and my reading  
19 of it is that the legend beside the line indicating the  
20 North Channel running from Sault Ste. Marie to  
21 Espanola, south to Manitoulin is called the North  
22 Channel siting zone.

23 So, in fact, the site for the North  
24 Channel reactor in the Demand/Supply Plan runs from  
25 Sault Ste. Marie to Espanola, south to Manitoulin

1 Island; isn't that correct?

2 MR. JOHANSEN: A. Well, a site is not  
3 the same as a siting zone. A zone is a large  
4 geographical area within which you look for potential  
5 sites as a general statement.

6 So, I think it is fair to say that  
7 whether you call it a zone or a study area, that you  
8 are talking about an area which is considered to be an  
9 area within which potential sites may be found. You  
10 can't say that that entire zone is the site.

11 Q. That entire zone is in jeopardy to be  
12 the site, Mr. Johansen; is that not correct?

13 A. That would be one way of putting it.  
14 That zone is an area within which, depending on where  
15 the potential sites are identified, there could be some  
16 potential impacts, yes. And, therefore, the notice  
17 needs to address those members of the public who might,  
18 therefore, legitimately have an interest in the  
19 proceedings.

20 Q. Now, we talked about the  
21 state-of-the-art cooling system that Dr. Effer talked  
22 about in Panel 8. I wondered if there was any  
23 information on the plume of the cooling water? That  
24 water comes out at a considerably warmer temperature  
25 than it went in; isn't that correct?

1 A. Yes, that's right.

2 Q. And we talked yesterday about the  
3 couple of hundred cubic metres per second.

4 A. Per second.

5 Q. So that means there is a couple  
6 hundred cubic metres per second at a considerably  
7 warmer temperature going out into whatever body of  
8 water is cooling this reactor?

9 A. Considerably it is a matter of  
10 interpretation, I guess.

11 I can tell you what the ballpark is. The  
12 guideline that the Ministry of the Environment  
13 maintains is that the temperature rise across the  
14 plant, is between, in simple terms, between the point  
15 of intake and the point of discharge, is to be no more  
16 than about 10 degrees, 10 Centigrade degrees, and it  
17 may indeed be less in certain site-specific  
18 circumstances.

19 Q. So every second there is 200 cubic  
20 metres of 10 degree warmer water going out into the  
21 lake?

22 A. Well, there is a considerable amount  
23 of thermal energy.

24 [10:14 a.m.]

25 Essentially, the energy from the fuel

1       which is not converted to electricity and excluding a  
2       certain amount which is emitted to the air through  
3       friction losses and other inefficiencies in the plant,  
4       but by and large the rest of the fuel energy is  
5       discharged to the lake.

6                   Q.   And let's go back to the North  
7       Channel.   The North Channel freezes from December  
8       until - it is probably still frozen - December until  
9       April.   So the water under that is probably around 32  
10      degrees, you would agree with that, or zero degrees  
11      Centigrade?

12                  A.   Yes.

13                  Q.   And so if there are fish that are  
14      getting ready to spawn they might get the wrong message  
15      when they feel 200 cubic metres a second of hot water  
16      coming out; the fish that spawn in the Blind River  
17      bank?

18                  A.   Well, one of the factors that would  
19      be considered in siting a plant to begin with, and  
20      secondly, in designing and specifically locating the  
21      cooling water structures would be the presence if any  
22      of spawning habitat.

23                  That was, I would say, the overriding  
24      factor in the design of the system at Darlington, and  
25      it was designed in particular to avoid a serious



1 adverse impact on what were considered to be valuable  
2 spawning habitat in that vicinity.

3 What you would try to do in any siting  
4 program would be to avoid any impact on spawning  
5 habitat by staying away from them, first of all.

6 If they are so prevalent - and I don't  
7 believe that is the case in the North Channel area -  
8 that you can't avoid them entirely, then you would need  
9 to design the system so that you minimize the impact.

10 Q. On what do you base that you don't  
11 believe that is the case in the North Channel area? I  
12 put it to you that you wouldn't find 50 feet along the  
13 North Channel that there wasn't something spawning.

14 A. Well, you are talking about the  
15 immediate shoreline area, I assume?

16 Q. I'm talking about the whole North  
17 Channel.

18 A. Well, that is not my information.

19 Q. So you can't really comment. That  
20 comment you made was a gratuitous comment?

21 A. Well, it is based on studies that  
22 were done back in the mid-to-late 70s when we looked at  
23 that region to begin with, but they are certainly not  
24 definitive studies.

25 All I am saying is as a matter of



1 planning strategy in looking for a site you would try  
2 to stay away from valuable habitat or other valuable  
3 features of the environment, and then, secondly, you  
4 would design the plant systems to minimize the impact  
5 on those features of the environment that you can't get  
6 away from.

7 Q. So getting back to the plume, what  
8 I'm interested in knowing is if Hydro has modelled the  
9 plume from the discharge.

10 A. Certainly.

11 Q. And do we have that?

12 A. We need to do that.

13 Q. Do we have that? Can you point me to  
14 that?

15 A. I am not sure if we actually -- I  
16 wouldn't be surprised if we issued...

17 We did issue a copy of the Darlington  
18 environmental assessment, and that included some  
19 thermal plume modelling.

20 Q. And that would be the same --

21 A. However, I should note that that was  
22 not based on the cooling water design. That was  
23 approved and--

24 Q. Eventually, yes.

25 A. --built in the end. However, it did

1 include, as I recall, some analysis of alternative  
2 cooling water discharge systems including, if memory  
3 serves, some fairly long offshore cooling water  
4 discharge structures as alternatives.

5           However, I can't say for sure that those  
6 alternative designs were exactly equivalent to the  
7 design that actually was built, but there was a range  
8 of thermal plume analysis included in that  
9 environmental assessment, and there were other  
10 responses to interrogatories pertaining to the impact  
11 of the cooling water system.

12           I just don't happen to recall if there  
13 was one on the definitive analysis that we had to do to  
14 get the permit from the Ministry for intake of water  
15 and for discharge of water.

16           Q. But presumably the basis would have  
17 been the EA, the environmental assessment, that was  
18 prepared and then any addenda that would have reflected  
19 the change.

20           A. Well, that environmental assessment  
21 allowed us, in fact, was the basis for government's  
22 approval to proceed with the project as a whole. Then,  
23 further approvals, of course, were required under the  
24 Environmental Protection and Water Resources Acts, and  
25 these are the ones that were the detailed, definitive

1 analyses, as I would call them--

2 Q. Right.

3 A. --based on the current CW design.

4 Q. So would you be able to get me copies  
5 of that, of those details of the plume, whatever you  
6 have? I don't want the environmental assessment  
7 document. It sounds like it is your submissions to the  
8 Ministry of the Environment for approval of that new  
9 Darlington intake/out-take plume.

10 THE CHAIRMAN: I thought you said that  
11 they were, that these analyses were part of the  
12 interrogatories that were put in?

13 MR. JOHANSEN: I'm not sure.

14 THE CHAIRMAN: Or is there a Darlington  
15 document already filed that would include that  
16 material; is that not right?

17 MR. JOHANSEN: I believe that the  
18 Darlington environmental assessment, the reference  
19 design at the time, which has been revised  
20 subsequently, plus the analysis of alternative schemes,  
21 including offshore discharge, would give you a pretty  
22 good range within which the actual design and the  
23 thermal plume discharge would fit.

24 MR. GREENSPOON: Q. Assuming that --

25 MR. JOHANSEN: A. So I think that

1 information is already on the record.

2 Q. All right.

3 A. And your further question about  
4 whether the interrogatories provided the more  
5 definitive analysis that we had to submit for the  
6 permits, that I can't recall.

7 All I do recall is that there were  
8 several questions about the effect of thermal plumes,  
9 fish impingement and the like, and --

10 MR. GREENSPOON: Well, Mr. Chairman, what  
11 I am interested in is an analysis of the plume that  
12 comes out of Darlington and how that will impact on the  
13 North Channel, and my witness who is studying the North  
14 Channel asked me to find out if there was a model of  
15 the plume from Darlington so he could extrapolate it  
16 into the North Channel to do the study.

17 THE CHAIRMAN: Apparently there is  
18 material on file, and perhaps your consultant should  
19 have a look at it and see whether it helps him or not.

20 MR. GREENSPOON: Yes.

21 MR. JOHANSEN: I should clarify that we  
22 have not selected a site at the North Channel.

23 MR. GREENSPOON: Q. Yes.

24 MR. JOHANSEN: A. The North Channel is  
25 off as per the moratorium.

1 Q. Yes.

2 A. Everything that we were beginning to  
3 study up there was halted, of course. So I don't think  
4 we should presume that there are going to be impacts up  
5 there. All of that is on hold.

6 Q. Although there are parties to this  
7 hearing that may be suggesting that would be a good  
8 place for a reactor, and we feel that it is important.

9 I wanted to ask you about the Zebra  
10 mussels. Is that you, Mr. Johansen?

11 A. I guess it is to some extent. This  
12 is the document incidentally that I was referring to,  
13 the Darlington EA, of which there is a copy filed.

14 THE CHAIRMAN: Well, could we identify it  
15 with an exhibit number or anything of that sort?

16 MR. JOHANSEN: It was 9.7.2, I think, but  
17 let me just confirm that. It was very early on.

18 The Darlington proposal, environmental  
19 assessment, this is the final submission dated 1976.  
20 There was an initial submission in 1975, but the one we  
21 filed is the one I just showed here, in response to  
22 Interrogatory 9.7.2.

23 THE CHAIRMAN: Which I think has already  
24 been given a number?

25 [10:25 a.m.]



1 MR. JOHANSEN: And I guess just a further  
2 comment to close the book on that. As I said  
3 yesterday, the Darlington design was optimized for the  
4 Darlington site. And it may or may not be relevant to  
5 the North Channel area if Hydro should ever consider  
6 going back there.

7 MR. GREENSPOON: Q. Now, the Zebra  
8 mussels are connected to that, the intake at these  
9 cooling plants.

10 MR. JOHANSEN: A. They are.

11 Q. And how does Hydro deal with Zebra  
12 mussels that are clogging the intake and the outlet?

13 A. Well, we have recently obtained  
14 approval from the Ministry of the Environment to use  
15 chlorination on an interim basis. And we have now for,  
16 I guess it's close to two years, been undertaking a  
17 research program to develop alternative methods of  
18 combating Zebra mussels, looking at a whole range of  
19 options, including non-chemical means in the hope that  
20 in the longer term a solution will be found that will  
21 not involve chlorination. And the Ministry supports  
22 that.

23 Q. So what do you do? Do you run the  
24 chlorination from the nuclear reactor or from the  
25 cooling water, or do you run it with divers out in the

1 water actually chlorinating the Zebra mussels that are  
2 adhering to the --

3 A. No, it's injected into the cooling  
4 water stream.

5 Q. Into the cooling water stream. So it  
6 follows the plume, then.

7 A. Yes. This is part of the  
8 requirements by the Ministry, the residual chlorine  
9 level has to be controlled to a very, very low level.  
10 I could dig up the figures if you'd like

11 Q. No, that's okay.

12 A. But that is one of the conditions of  
13 the approval from the Ministry, that the residual  
14 chlorine level that goes into the lake would be  
15 extremely small.

16 Q. Well, if you have 200 cubic metres a  
17 second, it wouldn't be very long to dilute any amount  
18 of chlorine, would it?

19 A. Well, we are talking about the  
20 residual chlorine at the point of discharge, not at  
21 some --

22 Q. Not out in the plume out in the  
23 middle of the lake.

24 A. No.

25 Q. And maybe that will help open the



1 beaches in Toronto if you put enough chlorine out.

2 A. Well, as I said, we are not putting a  
3 lot of chlorine out. It would be inefficient to do so.

4 Q. If you put it in the cooling water,  
5 how do you clean the Zebra mussels at the intake? You  
6 must have to do that from the water.

7 A. Physically, you mean?

8 Q. Well, the problem is the Zebra  
9 mussels, as I understand it, are clogging up the intake  
10 and the outlet. You said you put it in the cooling  
11 water. I gather that would help you out at the outlet,  
12 but it's not going to help you out at the inlet.

13 A. Well, it's the inlet that we are  
14 talking about.

15 Q. So you do it from the water, then.  
16 You go out in the lake.

17 A. Well, the concern is that these  
18 mussels not infest the plant systems and the heat  
19 exchange surfaces within the plant. I mean, that's the  
20 concern.

21 Q. Or that they completely block the  
22 inlet or the outlet.

23 A. Yes. We haven't experienced that  
24 problem yet, and I can't tell you what or if that is  
25 going to be a problem. No solution, obviously, has

1       been found to deal with that problem. If it does  
2       become a problem, the Darlington intake structure,  
3       being as it conforms, essentially, with the bottom of  
4       the lake bed, is thought to be more effective in  
5       discouraging the build-up of Zebra mussels.

6               And, I suppose it provides for more  
7       convenient clean up, if necessary. But this is a new  
8       problem for us. And is, I guess, one of the rare  
9       examples of where the impact of the environment is in  
10      our plants and not the other way around. And it's  
11      certainly an issue that is commanding a fair bit of  
12      attention from us and other water users around the  
13      Great Lakes, municipalities in particular.

14             Q. So, a Zebra mussel is causing you a  
15      problem and that's something that you are just  
16      beginning to learn how to deal with.

17             A. We are just beginning to learn how to  
18      deal with it, yes.

19             Q. And the Zebra mussels are moving up  
20      the lakes.

21             A. Yes.

22             Q. They are very vigorous.

23             A. At a greater rate, I might say, than  
24      we had hoped or anticipated a few years ago when the  
25      problem was first side in the lower lakes.

1 Q. Maybe they are part of the  
2 anti-nuclear movement.

3 If we could move to Exhibit 344, which  
4 is -- or 433, I think it is. Yes, Exhibit 433, which  
5 is the Alternative Energy Review.

6 THE CHAIRMAN: It's 344. You were right.

7 MR. GREENSPOON: 344. I was right. So  
8 my Panel 9 outline in my materials is wrong. It says  
9 433. Just while you are getting at that -- 344.

10 THE CHAIRMAN: That's the Alternative  
11 Energy Review.

12 MR. GREENSPOON: Yes. It looks like  
13 this, Mr. Penn.

14 MR. PENN: I know what it looks like.  
15 It's a matter of finding it. We don't seem to have  
16 that one, unless it's been misplaced.

17 MR. GREENSPOON: Well, Mr. Johansen, you  
18 don't need to bother with it. I think that I can ask  
19 you the questions without you seeing it.

20 MR. JOHANSEN: We'll see.

21 MR. GREENSPOON: Q. We'll see how it  
22 works. And I could pass you mine if you need it. Just  
23 before I delve into this, I'm not going to be very long  
24 on this issue, I just wanted to ask you my  
25 understanding is that Dr. Effer, who we heard from in

1 Panel 8, who in a parallel way, I suppose your role in  
2 this panel is similar to Dr. Effer's role in Panel 8.

3 MR. JOHANSEN: A. Well, as a matter of  
4 fact, Dr. Effer was my manager for many years, so we  
5 know each other well.

6 Q. And Dr. Effer, in fact, wrote the  
7 Environmental Assessment for Darlington. If one person  
8 could be ascribed to having written it, he would be the  
9 one.

10 A. Well, he was the manager. There were  
11 a lot of people who were part of the writing of the  
12 Darlington Environmental Assessment. I personally was  
13 one of them.

14 Q. And you were involved in that, as  
15 well.

16 A. Yes.

17 Q. Okay. And I asked Dr. Effer this  
18 question, and I presume that maybe you have got a  
19 update to the answer. Have you got the document?

20 A. Yes, we just found it.

21 Q. If you turn, you were talking  
22 about -- if you just could hold that and look at  
23 transcript Volume 122.

24 A. Page?

25 Q. Page 21301.

1 [10:35 a.m.]

2 A. Yes.

3 Q. And line 22?

4 A. Yes.

5 Q. You say that:

6 Our corporate environmental policy and  
7 management system are described in some  
8 detail in Exhibit 256, which is the 1990  
9 addition of our Corporate Environmental  
10 Performance Report or what we used to  
11 call the State-of-the-Environment Report.

12 A. Yes.

13 Q. Now, if you could turn to Appendix A  
14 of Exhibit 344.

15 A. Yes.

16 Q. Just reading at the top there you  
17 will see, and I pointed this out to Dr. Effer:

18 Ontario Hydro's existing corporate  
19 policy on the environment has the  
20 following governing principle: Ontario  
21 Hydro shall seek to manage all activities  
22 which affect the environment such that  
23 the Ontario community receives the  
24 greatest overall net benefit in the  
25 long-term. The existing policy was

1 developed in the 70s and is being  
2 revised. In 1990 a framework was  
3 developed to finalize Ontario Hydro's  
4 environmental principles which were  
5 drafted in 1989. The principles will  
6 express fundamental values on  
7 environmental leadership,  
8 decision-making, wise resource use,  
9 consultation and responsibility. The  
10 framework provides a basis for a Green  
11 Paper to be issued in 1991.

12 Now, has that paper been issued?

13 A. Not to my knowledge, no. As a matter  
14 of fact, our corporate newspaper just last week, I  
15 believe, it was, reported on a survey of Ontario Hydro  
16 staff regarding the question of environmental  
17 principles. So I believe that when this document was  
18 written, it appears somewhat optimistic about the  
19 completion of this Green Paper which I suppose I'm not  
20 intimately familiar with the actual planning process as  
21 far as updating the corporate policy on environment is  
22 concerned, but I do know that the process of updating  
23 the corporate environmental principles is very much  
24 ongoing at this time.

25 Q. Had you ever heard this Green Paper



1 before today?

2 A. Yes, as on objective, certainly.

3 Q. And just to finish up this item. If  
4 you look at bullet 3, these principles that they refer  
5 to as being part of the corporate environmental policy  
6 principle and strategy, that sentence lists them in  
7 order of preference. So, in other words, they are  
8 prioritizing basic emission control principles.

9 Would it be fair to say that those  
10 emissions control principles apply to nuclear power?

11 A. Most certainly.

12 Q. Most certainly.

13 A. And that is the sort of thing I was  
14 alluding to before when we were talking about cooling  
15 water design, avoid or eliminate to begin with, and  
16 then, if you must deal with some unavoidable feature of  
17 the environment, then minimize the impact.

18 Q. So the first principle at Ontario  
19 Hydro as to emissions is elimination?

20 A. At source, yes.

21 Q. And if that can be done by the use of  
22 zero discharge or recycling systems, Hydro will do  
23 that?

24 A. Well, elimination doesn't necessarily  
25 mean zero discharge. If it means elimination at

1 source, for example, removing tritium from heavy water,  
2 converting the annulus gas system at Pickering to  
3 reduce or eliminate carbon-14 as a source, substitution  
4 of materials, for example, we know longer use PCBs in  
5 our electrical equipment, that's elimination at source.

6 Q. If you just read on, I think what you  
7 are talking about there, on that first bullet,  
8 elimination, you are talking about, it says:

9 This can be accomplished through the  
10 selection of processes which avoid waste  
11 production.

12 That's what you are talking about.

13 So the first principle of elimination is  
14 avoid producing the waste in the first place.

15 A. That's right.

16 Q. But the second and third are using  
17 zero discharge systems or a recycling system. Those  
18 are two other ways you can eliminate discharges. There  
19 is three ways: You don't produce the product; the  
20 second way is you have zero discharge, and the third  
21 way is you recycle it.

22 A. Well, zero discharge is a concept  
23 which has been around for a long time, and the extent  
24 to which you approach zero discharge is a case or site  
25 specific question. And it may be that in the case of

1 certain contaminants you do indeed practice zero  
2 discharge preferably by eliminating the source.

3 Recycling or reuse, in my view, would be  
4 part of any smart environmental control system, and I  
5 don't really I see it as a separate or distinct control  
6 option. It would be part of any overall control  
7 program.

8 Q. Okay. I take it that Ontario Hydro  
9 has, or this panel has, no evidence about the emissions  
10 of uranium trioxide from the Cameco nuclear refinery in  
11 Blind River, and the fact that there is 500 grams of  
12 uranium trioxide allowed to be emitted from that  
13 refinery every year, and that there have been spills  
14 where that amount was released in two or three days.

15 THE CHAIRMAN: Take it one step at a  
16 time. Ask them first whether they know anything about  
17 the uranium trioxide.

18 MR. GREENSPOON: Q. Do you know anything  
19 about uranium trioxide?

20 MR. JOHANSEN: A. Well, your initial  
21 question was whether we did any assessment of the  
22 impacts of the uranium trioxide or the refining process  
23 at Cameco, and the answer to that is no, we have not  
24 done a specific environmental or safety assessment of  
25 that stage nor have we done specific environmental or

1 safety assessments of the uranium mining or milling or,  
2 indeed, the conversion step.

3 What we have done and documented in  
4 Exhibit 507, I believe as we have discussed before, is  
5 taken Ontario Hydro's quantities and married those  
6 Ontario Hydro quantities with risk factors reported in  
7 what we consider to be credible authoritative  
8 literature and come up with an overall estimate of risk  
9 on a unit energy basis for the different steps. So  
10 what we have done is a generic literature-based  
11 assessment, but no plant-specific or site-specific  
12 analysis.

13 Q. So when this Board wants to look at  
14 the environmental impacts of nuclear power on the  
15 ground, on the environment, we have no evidence from  
16 Ontario Hydro about what is going on at Blind River on  
17 the North Channel of Lake Huron at the Cameco nuclear  
18 refinery where your fuel is refined?

19 A. I think what we have put on the  
20 record is a general assessment of those impacts and  
21 risks which could reasonably be attributed to the  
22 materials that go to supply Ontario Hydro's fuel. We  
23 have not assumed, nor do we think it's appropriate to  
24 assume, that all of the impacts which may result from  
25 whatever activities go on at Cameco's or mining

1 company's facilities, that we have not assumed or  
2 documented those sort of impacts in our Exhibit 507.

3 As I have pointed out, Ontario Hydro's  
4 fuel supply accounts for only about 10 per cent of the  
5 Elliot Lake mining business.

6 Q. In volume?

7 A. In volume, yes, that's what we are  
8 talking about.

9 Q. And is that the case at Blind River?  
10 Nobody else wants uranium trioxide, just Ontario Hydro;  
11 isn't that right?

12 A. There are other CANDU operators in  
13 this country and elsewhere.

14 I also yesterday, I think, indicated that  
15 while Ontario Hydro has accounted for something like 10  
16 per cent of the mining activity at Elliot Lake, if you  
17 look at mining activity in Saskatchewan as well, and we  
18 are talking about overall Canadian mining and refining  
19 activity, perhaps our share is between 11 and 12 per  
20 cent, as near as I can figure from the ONCI  
21 documentation and advice from fuels people.

22 Q. But again just to be clear, when you  
23 talk about your share, you are talking the volume of  
24 uranium ore that you purchase?

25 A. Yes.

1 Q. And it has no relationship to the  
2 amount of money that you sunk into the uranium industry  
3 as we showed --

4 THE CHAIRMAN: He has made that clear, I  
5 think.

6 MR. JOHANSEN: I am not talking about  
7 socio-economic impact, if that's what you are  
8 inferring.

9 MR. GREENSPOON: Q. So, Hydro offers no  
10 evidence --

11 THE CHAIRMAN: That's an argumentative  
12 question. Mr. Greenspoon, you have said that before  
13 and I am going to listen to it again. There are  
14 certain things on the record, whether it's evidence or  
15 not is an argument question. I don't think you should  
16 ask him those terms.

17 MR. GREENSPOON: Q. Do you know anything  
18 about the environmental impacts on the Mississagi River  
19 of the Blind River nuclear refinery?

20 MR. JOHANSEN: A. Ad hoc information, I  
21 don't pretend to be an expert in that area of the fuel  
22 cycle, fuel chain.

23 Q. Or that that river is the last  
24 spawning ground, on the Great Lakes, of sturgeon?

25 A. Well, there are certainly people in



1 my department who would know a lot more about that than  
2 I.

3 We have looked at the potential of that  
4 river for hydroelectric development purposes, so there  
5 are people in the department that know something about  
6 it, but I am not one of them.

7 Q. I wanted to move on to high level  
8 waste, please.

9 Mr. Penn, I guess you spoke more than  
10 anybody on that, although I think Mr. Johansen spoke as  
11 well.

12 If you could turn to my materials. Page  
13 20 this is a letter dated the 23rd of September, 1988  
14 and it is from Marcel Masse who was the Minister of  
15 Energy federally at the time, to Tom McMillan who was  
16 of the Minister of the Environment at a the time. Have  
17 you a chance to read this letter, Mr. Penn?

18 MR. PENN: A. Yes, I have.

19 Q. Would it be fair to say this that  
20 this could be called the letter of reference of the  
21 high level waste concept to an environmental  
22 assessment?

23 A. It's a letter of reference to the  
24 Minister of the Environment from the Minister of  
25 Energy, Mines and Resources, that the proponent, Atomic

1 Energy of Canada Limited, on behalf of the federal  
2 government, to talk about technology of disposal of  
3 used fuel, is wishing to have the matter reviewed.

4 Q. Yes. And in the first paragraph  
5 specifically, the specific concept of deep geological  
6 disposal of nuclear fuel wastes in Canada, along with a  
7 broad range of nuclear fuel waste management issues.

8 So this would be what could be called a  
9 terms of reference?

10 A. Well, this reflects the joint  
11 agreement between the federal government and the  
12 provincial government and Atomic Energy of Canada and  
13 Ontario Hydro in 1978, based, I think, on Dr. Kenneth  
14 Hare's advice that work should proceed to evaluate the  
15 deep geological disposal of nuclear fuel.

16 Q. If we could turn to page 23, page 4  
17 of the letter.

18 MR. JOHANSEN: A. Mr. Greenspoon, I  
19 wonder if I could just inject a point. You offered the  
20 view that these were the terms of reference. It might  
21 appear that, but as a matter of standard practice, this  
22 is the sort of letter that initiates the federal  
23 environmental assessment and review process for an  
24 undertaking. So you quite correctly referred to it as  
25 a reference or referral letter, but the terms of terms

1 of reference are established by the panel--

2 Q. Of course.

3 A. --that was established subsequent to  
4 this and they did issue specific terms of reference.

5 Q. Yes. But it is a guideline under an  
6 order in council. It's not under a statute, so it is a  
7 Minister who refers it. There is no Federal  
8 Environmental Assessment Act. This is under an order  
9 in council?

10 A. That's right.

11 Q. So, it's this reference and then, as  
12 you say, the panel is struck.

13 [10:50 a.m.]

14 Let's just turn to page 4 and look at the  
15 second last paragraph:

16 Ontario produces the bulk of Canada's  
17 used nuclear fuel and has participated in  
18 the research and development phase of the  
19 concept. It is important to have  
20 Ontario's full cooperation of all stages  
21 in the review. In carrying out the  
22 review the Panel should ensure to the  
23 extent possible that the principles of  
24 Ontario's environmental assessment  
25 process are accommodated.

1 Do you know if that's been done, Mr. Penn, if the  
2 principles of Ontario's environmental assessment  
3 process have been accommodated by the federal review?

4 THE CHAIRMAN: Well, the record of what  
5 is going on in Ottawa under this review is well  
6 documented and most of it is on the record. I don't  
7 know what Mr. Penn can add to that.

8 MR. GREENSPOON: Q. Do you know if under  
9 the process on the federal environmental assessment  
10 process cross-examination of witnesses is allowed, for  
11 example, Mr. Penn?

12 MR. PENN: A. I'm afraid I'm not  
13 familiar with the process under the federal  
14 environmental assessment hearing.

15 Q. And, I guess, then, you don't know if  
16 there is intervenor funding for lawyers, for parties  
17 that are involved?

18 A. Well, all I can tell you is that  
19 there is an extremely thorough examination expected of  
20 all issues associated with deep geological disposal and  
21 alternative methods to it and alternative approaches to  
22 the use of that energy. I can't tell you what the  
23 process that this hearing is going to follow is because  
24 I don't know.

25 MR. JOHANSEN: A. Mr. Greenspoon, I

1 suppose you noted it yourself, that at the present the  
2 federal environmental assessment process is not under  
3 an act or Environmental Assessment Act. It is pursuant  
4 to guidelines order.

5 And this matter of the federal  
6 Environmental Assessment Act is a current one, and it  
7 is anticipated that that legislation is going to be  
8 issued sometime in the foreseeable future. So I think  
9 we are probably discussing an area that is subject to  
10 change within the time span certainly of this review  
11 process.

12 Q. But that new act won't apply to this  
13 hearing, Mr. Johansen. This hearing has already  
14 started. Under the guidelines you are not going to --  
15 the act won't be retroactive.

16 A. The hearing hasn't started.

17 Q. Well, of course it has.

18 THE CHAIRMAN: Please, would you tell me  
19 what the relevance of this line of questioning is to  
20 this hearing? I just can't follow this at all.

21 MR. GREENSPOON: Well, Mr. Chairman,  
22 Ontario Hydro has put forward the proposition that we  
23 are going to have a solution to the high level waste by  
24 the year 2025, and this letter, to me, in my  
25 submission - and it would be a matter of argument -

1 indicates that there should be input from the Ontario  
2 environmental assessment process. And there isn't any.

3 THE CHAIRMAN: No, it doesn't say that at  
4 all.

5 MR. GREENSPOON: Well, it says it --

6 THE CHAIRMAN: Listen to me. It says:

7 In carrying out the review the panel  
8 should ensure to the extent possible that  
9 the principles of Ontario environmental  
10 assessment process are accommodated.

11 That is what it says.

12 MR. GREENSPOON: Yes, that is what it  
13 says. And if there is no cross-examination of  
14 witnesses it would be hard to say that the process of  
15 Ontario environmental assessment has been accommodated.

16 THE CHAIRMAN: Well, I don't think this  
17 is very useful to us, this kind of examination.

18 MR. GREENSPOON: All right. I will move  
19 on.

20 Q. Mr. Penn, you and Mr. Johansen, you  
21 both have been in the North Channel area. I think you  
22 have indicated that?

23 MR. PENN: A. Yes, I visited the North  
24 Channel area.

25 Q. Do you know the Town of Massey, does



1       that ring a bell?

2                   A. I'm sure I passed through it. I  
3       don't know the town, no.

4                   Q. Well, if you look at the map that I  
5       provided in my materials on page 26 you will see that  
6       Massey is on the TransCanada Highway?

7                   A. Yes, I can see Massey.

8                   Q. You can see it?

9                   A. Yes.

10                  Q. And you see a highway numbered 553  
11       that goes north from Massey?

12                  A. Yes, I do.

13                  Q. And it crosses the aux Sables River  
14       and then appears to drain a lake at the end of that  
15       highway?

16                  A. Yes.

17                  Q. Unfortunately, it is not on that map,  
18       I don't think, Dr. Connell.

19                  MR. CONNELL: Oh.

20                  THE CHAIRMAN: This map.

21                  DR. CONNELL: Oh, I see.

22                  MR. GREENSPOON: Q. Are you aware that  
23       in the 80s, I think around 1980, Atomic Energy of  
24       Canada Ltd. set up an office in Massey, Mr. Penn, to  
25       research this high level waste concept?

1 MR. PENN: A. No, I wasn't aware of  
2 that.

3 MR. JOHANSEN: A. I --

4 Q. You are aware of that, Mr. Johansen?

5 A. I am aware of that, yes, and I should  
6 clarify that that was for purposes of field  
7 investigation. It was not for purposes of testing  
8 whether the Massey area of the Canadian Shield was a  
9 suitable site for a repository.

10 So I think field research which was  
11 carried out over a number of areas of the Canadian  
12 Shield so that the assessment program had reasonably  
13 representative information on the nature of the host  
14 block or potential host block could be obtained. That  
15 is one thing.

16 Q. Well, the Canadian Shield goes under  
17 Toronto, doesn't it, if you go down far enough? They  
18 didn't do any drilling in Toronto, I don't think, did  
19 they?

20 A. It is not exposed at Toronto, is it.

21 Q. Well, it's not exposed at Massey  
22 either, is it?

23 A. The field work was not carried on  
24 right in the Town of Massey.

25 Q. No, at East Bull Lake, which is the

1 lake that I pointed out--

2 A. Yes.

3 Q. --that drains, that the Sables River  
4 drains. There was drilling done there to find plutons,  
5 as Mr. Penn said, to find the plutons in the granite to  
6 see if they could put high level waste in a pluton like  
7 that.

8 A. It wasn't to find the plutons,  
9 plutons had been identified by the Geological Survey of  
10 Canada many years before that in the early to mid-70s.

11 The work that AECL and their contractors  
12 carried out, which you are referring to, was for  
13 purposes of gaining information on the nature of rock  
14 in plutons at various locations across the Canadian  
15 Shield for purposes of parameters, quantifying  
16 parameters needed to carry out the environmental and  
17 safety assessment of the concept, not for siting  
18 purposes.

19 Q. Is there any question in your mind  
20 that if the high level waste is buried in plutons that  
21 it will be somewhere but Ontario?

22 A. I think there is a double negative  
23 there.

24 Q. Well, you know what I mean. There is  
25 no question that it will be buried in Ontario if it is

1 buried anywhere?

2 A. Well, that was the recommendation by  
3 the Hare Commission back in 1977, that geological  
4 disposal be investigated based on the Canadian Shield,  
5 and I believe the rationale was generally that because  
6 Ontario is going to be the province where the bulk of  
7 the used fuel already has been accumulated and was  
8 foreseen to continue to accumulate, that for that  
9 reason a particular focus on the Ontario portion of the  
10 Canadian Shield is appropriate.

11 That is not quite the same as saying that  
12 it definitely will be in Ontario, but my personal view  
13 is that that would not be inappropriate for the reasons  
14 given by Mr. Hare and his committee.

15 Q. And just to close this off, it would  
16 also be fair to say that it is not likely going to end  
17 up under Toronto in the Canadian Shield; it is going to  
18 end up in Northern Ontario?

19 A. Well, there were no plutons  
20 identified in the Toronto area. However, there are  
21 plutons identified across the Canadian Shield, which  
22 does extend into what you might call Southern Ontario  
23 but not as far as Toronto.

24 Q. But the only place that we know of  
25 where they have done drilling in Ontario is Massey?

1 A. No.

2 Q. Where else have they done drilling?

3 A. They have done drilling in the  
4 Atikokan area and at eastern -- or I guess you would  
5 call the northeastern parts of the province and  
6 obtained information that was readily available from  
7 closer locations.

8 I mean, they went, and drilled, and did  
9 field testing in areas of the province where there  
10 hadn't been information obtained from mining  
11 activities, for instance, in other areas of the  
12 Canadian Shield.

13 Q. So are there any areas other than in  
14 Northern Ontario, the Kirkland Lake/Atikokan/Massey  
15 areas where drilling has been done?

16 A. I can't, off hand, tell you all the  
17 areas where field information has been obtained and  
18 where drilling has been done, but Massey certainly was  
19 not, or East Bull Lake was not the only one.

20 As a matter of fact, information has been  
21 obtained from the vicinity of the White Shell  
22 Laboratories of AECL as a matter of convenience, and I  
23 believe Mr. Penn referred to the underground research  
24 laboratory in the White Shell vicinity, which is part  
25 of the research program that AECL has been undertaking

1 now for well over 10 years.

2 Q. But there is a statute in fact in  
3 Manitoba that prohibits high level waste from being  
4 buried there?

5 A. Well, again, I would like to  
6 emphasize the distinction between field research for  
7 concept assessment purposes and subsequent field  
8 research which might be undertaken if and when the  
9 concept is accepted and the question is where to site  
10 it. That is a totally separate matter and hasn't been  
11 started yet.

12 Q. Mr. Penn, just getting back to the  
13 cost, the LUEC, with respect to this high level waste,  
14 if in fact the federal environmental assessment process  
15 finds that there is not a suitable way to dispose of  
16 this at all, that it shouldn't be disposed of, how does  
17 that impact on the LUEC if it has got to be guarded for  
18 hundreds of thousands of years?

19 MR. PENN: A. Well, the first thing I  
20 should say is that there are many nations in the world,  
21 developed nations, that have reviewed different host  
22 repository for used fuel, in Sweden, in Germany, in the  
23 United States, in the United Kingdom, and France, in  
24 Japan, as well as Canada, and there has been an  
25 extensive international collaboration on this matter.



1 So, I can't accept your hypothesis that technology  
2 can't be found that is not suitable, and that I presume  
3 what you are suggesting was that there would be a  
4 surface depository that needs to be guarded for a very  
5 long time, and I don't think that that is at all  
6 evident.

7 Q. But it may be that in a democratic  
8 society that we live in that the people of Canada  
9 through their elected officials and through the  
10 processes decide that is what in fact has to be done,  
11 that we can't take the risk to bury it, that we have to  
12 leave it above the ground?

13 A. Well, there is a very eminent group  
14 of science advisors that are totally independent of the  
15 electrical or the uranium industry to advise the  
16 hearing that we have just been talking about that is  
17 now going to occur or will be starting in 1993, and  
18 there are many issues that will be debated and reviewed  
19 at that time, not the least of which is whether we, as  
20 today's society, should dispose of a very significant  
21 energy source which could not be retrieved. That is an  
22 issue.

23 [11:04 a.m.]

24 Q. So in any case, the answer to the  
25 above-ground storage that I suggest and how that would

1 impact on the LUEC is unknown to you?

2 A. Well, it's unknown because no one in  
3 the world, with all the extensive amount of research in  
4 this field, is suggesting that a surface facility is  
5 the way to go.

6 Q. Well, all of my clients are  
7 suggesting that, Mr. Penn.

8 A. Well, no one that's worked in the  
9 field for the last 10 or 15 years has suggested it, Mr.  
10 Greenspoon.

11 Q. In Exhibit 349, have you got that,  
12 Mr. Penn? Or I'm sorry. That's not the one I want.  
13 Exhibit 117. I think it's the last page of my  
14 materials, Mr. Chairman.

15 THE CHAIRMAN: 117 is what?

16 MR. GREENSPOON: The second-last page of  
17 my materials. It's an exhibit that I introduced --

18 THE CHAIRMAN: Oh, yes, all right.

19 MR. GREENSPOON: Do you have it?

20 Q. Mr. Penn, were you, logically, if you  
21 will look at the dates in the unit -- have you looked  
22 at this prior to today?

23 MR. PENN: A. Well, the second-last page  
24 that I've turned up isn't marked Exhibit 117, so we  
25 better make sure that I'm looking at the right thing.

1 Q. It's a table that lists generating  
2 stations into the future, into 1997, starting in 1977.  
3 Units in service in years shown.

4 A. This is entitled, The Generation  
5 Proposed in program LRF 48A.

6 Q. That's it, at the bottom.

7 A. Thank you.

8 Q. That's Exhibit 117. Now, in '77,  
9 assuming we don't have a date for the document, I think  
10 when I introduced it I showed the panel the document  
11 that it came from but I didn't file it at the time.

12 But just for the purpose this have  
13 discussion, those '77, '78, those are presumably 1977,  
14 1978.

15 A. Yes. Well, many years ago and before  
16 our planners presented information in the form that's  
17 given in Exhibit 3, which is the DSP and in the Update,  
18 annual long-range forecasts were done on a yearly  
19 basis.

20 And I can vaguely remember when I joined  
21 Ontario Hydro in the '70s, actually 1977, that LRF 48A  
22 was produced probably in '75 or '74, that era.

23 Q. All I wanted to use this for was to  
24 ask you about, if you look on the second column it  
25 says, Type, and the legend indicates that what means,

1       that "F" is the fossil and "N" is nuclear.

2                   And I just want to look at the "N"s, just  
3       the nuclear. And if we go over to E-16, go down to  
4       E-16 and go over -- I'm sorry, if we go down two above  
5       that, we have got Darlington. Because I guess  
6       Darlington was forecast to be a little bit earlier in  
7       those days.

8                   If you go down to Darlington, 4 by 850,  
9       it was forecast to be forecast in '85 unit by unit each  
10      year in that exhibit, '85, '86, '87, '88. Now, I just  
11      wanted to look at all of the nuclear, and just quickly  
12      ask you if you could identify, for example, what kind  
13      of reactor E-15 was, 4 by 516?

14                  A. Well, that would be a repeat  
15      Pickering "B" style.

16                  Q. And E-16 would be a CANDU 4 by 881,  
17      what we know as a 4 by 881, now?

18                  A. That is correct.

19                  Q. And E-19, 4 by 850, what is that?

20                  A. That would be the same thing.

21                  Q. Same one. E-20, 4 by 1200, what is  
22      that?

23                  A. Well, many, many years ago, and just  
24      so that, Mr. Chairman, you have a bit of background on  
25      this, the gross rate of electricity in our province was

1 7 per cent per year compounded, which means that the  
2 capacity needed to be doubled every ten years in our  
3 system.

4 And this was produced in that era with  
5 the expectation that our province's economy would grow  
6 at this continued rate. And at that time we did some  
7 studies on a multi-unit, 1,200 megawatt size plant.

8 Q. What I wanted to know is what that  
9 was. What is a 1,200 megawatt unit? Is that a CANDU?

10 A. It's just a larger CANDU plant that  
11 we studied and we looked at the economics of it  
12 compared with a 4 by 881 and determined that the  
13 advantage of going to that higher capacity was too  
14 small to warrant that development.

15 Q. And was one of those every built, do  
16 we know? Because I don't recall seeing a 12 --

17 A. It never left of the drawing board.  
18 I'm trying to tell you it was study.

19 Q. So did AECL have one of those in mind  
20 at some point?

21 A. It was nothing to do with AECL. It  
22 was an Ontario Hydro study.

23 Q. You thought maybe a 1,200 megawatt  
24 unit could be built.

25 A. We spent two or three years looking

1 at the feasibility of a 1,200 megawatt unit.

2 Q. I just want to move on, lastly, to  
3 Exhibit 641, which you filed at the end of Mr. Poch's  
4 cross-examination.

5 Just before I do that, I'm sorry. If you  
6 could just turn up in my materials an article from the  
7 Globe and Mail. I think it appears at page 72.

8 A. Yes, I have that.

9 Q. Now, Espanola, we agreed earlier, was  
10 in the siting map for this hearing. And  
11 coincidentally, I don't suppose there is any  
12 significance, Espanola is the subject of a major  
13 Ontario Hydro pilot project, you are aware of that, for  
14 conservation and efficiency?

15 A. Yes, I am.

16 Q. I just wanted to ask you about one  
17 paragraph in there. And that would be, if you go to  
18 the last column of the article, and the third paragraph  
19 from the bottom, starting "For it's part." Do you see  
20 that?

21 A. Yes, I do.

22 Q. And I'll just read it. And I'd like  
23 you to comment about what the basis of that statement  
24 is.

25 For it's part the utility will pay



1 about \$9,650 for the renovations. But  
2 Peter DiAngelo, the Espanola project  
3 leader, says the utility would have to  
4 spend even more to build the generating  
5 capacity achieved through conservation.

6 Is that a statement made by an Ontario  
7 Hydro employee? Is Peter DiAngelo the project leader  
8 for the utility or is he a third party; do you know?

9 A. Well, I think you would have to ask  
10 Panel 10, because I don't know a person named Peter  
11 DiAngelo.

12 Q. All right.

13 MR. B. CAMPBELL: Well, just a minute. I  
14 don't know and I'm not going to give any assurance to  
15 my friend that Panel 10 is going to be familiar with  
16 this kind of level of detail. We have been quite  
17 explicit in scoping that they would not go back into  
18 this level of detail on Panel 10.

19 I think the information on the Espanola  
20 project was spoken to by Panel 4, and they spoke to the  
21 carrying out of these kinds of comparisons. I read  
22 this as simply being a statement that, apart entirely  
23 from the figure, Hydro's expectation is that whatever  
24 this figure refers to is below the avoided cost. That  
25 was all dealt with in Panel 4.

1 THE CHAIRMAN: That's what I would have  
2 taken it to mean.

3 MR. GREENSPOON: Well, I don't know. I  
4 don't know how many people in Espanola would even know  
5 what avoidance cost means.

6 THE CHAIRMAN: Well, I hope that we have  
7 some idea what Hydro thinks it means.

8 MR. GREENSPOON: Yes. Nothing turns on  
9 it. I just wondered if he was an employee and whether  
10 that is Hydro's position. But I suppose we will find  
11 out in Panel 10 something about Espanola.

12 MR. B. CAMPBELL: I think, Mr. Chairman,  
13 with respect I think it's been spoken to already in  
14 Panel 4.

15 [11:15 p.m.]

16 THE CHAIRMAN: We found out about it on  
17 Panel 4. You got the total customer cost, you got all  
18 those concepts, they were all dealt with. Espanola  
19 specifically was dealt with in that panel.

20 MR. GREENSPOON: Q. So now going to  
21 Exhibit 461, Mr. Penn.

22 MR. PENN: A. Yes, I have that.

23 Q. Now, I think you said to Mr. Poch  
24 that your projection for a 4 by 881 in the future,  
25 2011, is going to be less, just from a forecasting

1 point of view, I'm not going to say it's going to be  
2 built, I understand that Hydro is not planning to build  
3 one, you are going to build, in your estimate, a 4 by  
4 881 in 2011 cheaper than you built Darlington. My  
5 question is, how possibly in this day and age can  
6 something be built cheaper in the future than it was in  
7 the past?

8 THE CHAIRMAN: You noticed it's 1991 in  
9 Canadian dollars that we are talking about when he  
10 talks about that. You understand that?

11 MR. GREENSPOON: Yes. Well, that makes  
12 it cheaper in my simplistic understanding. Maybe Mr.  
13 Penn can explain that.

14 Q. Is that not what this means, that you  
15 are going to build it for less money in today's  
16 dollars?

17 MR. PENN: A. It means that the capital  
18 cost in dollars per kilowatt will be less for a new 4  
19 by 881 station, based upon the Darlington design, than  
20 Darlington is.

21 I don't know how much time we have got  
22 today to discuss this topic, I would be delighted to  
23 review with you the detail of five years of work that I  
24 managed that led to this, and of course it was subject  
25 to the ONCI inquiry, which is Exhibit 43, and has been

1 updated for this hearing in very considerable detail.

2 Q. I don't expect you to go through all  
3 that. I just wanted to be clear that that was what  
4 this said.

5 A. It says, and my memory serves me, I  
6 think I testified that it is 13 per cent less.

7 Q. So you expect to save money, and I  
8 gather without getting into the details, one of the  
9 reasons you expect to save money is because you have  
10 already done it once before.

11 A. We haven't completely done it before,  
12 but we would expect another 4 by 881 to have a very  
13 significant design content from Darlington.

14 We have elaborated on the various  
15 constructability studies that have been performed to  
16 show how better to construct the plant in the future.

17 We have developed, as I said in my direct  
18 evidence, computer concepts that allow three  
19 dimensional modelling of the total design and the total  
20 data base of the system. We have looked at methods of  
21 working at the site and site planning, and many, many  
22 other issues associated with the present design of  
23 Darlington.

24 MR. GREENSPOON: Those are all the  
25 questions, I have. Thank you.

1 THE CHAIRMAN: Are you next, Mr. Mondrow?

2 MR. MONDROW: Yes, sir. If we could have  
3 the break, we will get ourselves organized.

4 THE CHAIRMAN: All right. We will break.  
5 For 15 minutes.

6 THE REGISTRAR: The hearing will take a  
7 15-minute recess.

8 ---Recess at 11:17 a.m.

9 ---On resuming at 11:45 a.m.

10 THE REGISTRAR: Please come to order.

11 This hearing is now in session. Please be seated.

12 MR. MONDROW: Thank you, Mr. Chairman.

13 Good morning, gentlemen. My name is Ian  
14 Mondrow, I am co-counsel for IPPSO.

15 With me today I have Mr. William Marcus  
16 who is principal and chief economist of JBS Energy  
17 Inc., an energy, economics and engineering firm based  
18 in Sacramento.

19 Mr. Chairman, there are some materials I  
20 will be referring to during this examination. There  
21 are additional copies here on the table for those who  
22 would like.

23 The first two have been prefiled already.  
24 Exhibit 521 is a document entitled: Evaluating the  
25 Premature Retirement of Nuclear Facilities: A Case



1 Study, and Exhibit 522 is entitled: Canadian Nuclear  
2 Association Brief to the Standing Committee Ontario  
3 Energy, Mines and Resources.

4 THE CHAIRMAN: So the second one was 522,  
5 was it?

6 MR. MONDROW: Yes, sir.

7 THE CHAIRMAN: Thank you.

8 MR. MONDROW: In addition, I would like  
9 to file two new exhibits which have been provided to  
10 Mr. Lucas and Ontario Hydro. I would like the first new  
11 number if I could have it, please, for the exhibit  
12 entitled: Miscellaneous References for IPPSO's  
13 Cross-Examination of Ontario Hydro Witness Panel 9.

14 THE REGISTRAR: That will be 647.

15 ---EXHIBIT NO. 647: Document entitled: Miscellaneous  
16 References for IPPSO's Cross-Examination  
of Ontario Hydro Witness Panel 9.

17 MR. MONDROW: Then the second new  
18 exhibit, which would be 648, is entitled: State of the  
19 World Report, 1992 Article Entitled Confronting Nuclear  
20 Waste.

21 ---EXHIBIT NO. 648: Document entitled State of the  
22 World Report, 1992 Article Entitled  
Confronting Nuclear Waste.

23 MR. MONDROW: We have also provided a  
24 package of the interrogatory response excerpts that we  
25 will be referring to, which will be given exhibit



1 numbers, of course, as we go.

2 Mr. Chairman, we won't be spending time  
3 on the natural environment and the health issues per se  
4 associated with nuclear generation, relying rather on  
5 the examination of others, the Coalition Environmental  
6 Groups, Ontario Public Health and others on those  
7 matters.

8 We will be spending some time on the  
9 technical and operational aspects of Ontario Hydro's  
10 nuclear facilities and programs, and on the costs and  
11 the costing of those programs and facilities.

12 My guess, Mr. Chairman, is that we will  
13 be finished sometime on Monday and I will of course  
14 update as we progress.

15 THE CHAIRMAN: You are taking into  
16 account that we are not sitting tomorrow?

17 MR. MONDROW: Yes. Thank you.

18 THE CHAIRMAN: Thank you.

19 CROSS-EXAMINATION BY MR. MONDROW:

20 Q. I would like to start, please,  
21 gentlemen, just by putting some context, I hope, on  
22 some of the historical information you have already  
23 provided, and to do that you will see that I have  
24 produced kind of a time line at page 1 of Exhibit 647.  
25 If we could have the overhead turned on, please, for

1       that. Thank you.

2                   You will see from the legend in the  
3       bottom left corner that I have plotted the lines in two  
4       phases, the first being the commitment, design and  
5       construction phase, and the second being the operation  
6       phase for the nuclear facilities.

7                   Mr. Daly or Mr. Penn, you might be  
8       appropriately able to answer. I am not concerned with  
9       the pinpoint specifics of this, but do you agree that  
10      this time line roughly tracks Ontario Hydro's nuclear  
11      generation program?

12                  MR. PENN: A. Well, subject to check, it  
13      appears all right.

14                  I just mentioned that Ontario Hydro has  
15      put on record precise dates of commitment of the  
16      various plants and in-service. It seems about right.

17                  Q. It is just roughly I want to get a  
18      picture of this.

19                  I have also roughly scaled the blocks  
20      then by size of the facilities, you will see at the top  
21      starting with NPD and Douglas Point and moving on  
22      through the other stations. Does that have give an  
23      accurate picture of the relative sizes of facilities,  
24      roughly? They get bigger as we go down?

25                  A. Well, it's a descriptive schematic.

1 Q. That is fine. Thank you.

2 Just looking then at this time line we  
3 can see that in a decade from 1964, the announcement at  
4 Pickering "A", about to the mid-70s you started five  
5 nuclear stations with 20 reactors and over 14,000  
6 megawatts of total capacity, a pretty busy 10 years for  
7 nuclear construction; would you agree with that, Mr.  
8 Penn?

9 A. Yes.

10 Q. And the beginning of the waste  
11 disposal concept investigation followed this frenzy of  
12 construction starts. The agreement to start work on  
13 that disposal was put in place between the two levels  
14 of government and AECL and Ontario Hydro in 1978; is  
15 that correct?

16 A. I disagree with the word "frenzy".  
17 It was a planned approach to the program and yes--

18 Q. No pejorative intended.

19 A. --and yes the used fuel initiative  
20 started in 1978.

21 Q. And you can see I have plotted that  
22 on my time line here as well.

23 I have also indicated the start date of  
24 preliminary work by AECL on their underground research  
25 facility which was 1982. Now, the work schedule for

1 the repository concept does not have exactly the same  
2 kind of critical path that the generation facilities  
3 do. But it would be fair, I think, to look at the date  
4 2003 as akin, on a conservative estimate, to the start  
5 dates that I used for the stations, 2003 being the  
6 projected start date for site characterization; is that  
7 fair?

8 A. Well, I think Mr. Johansen gave an  
9 actual schedule. Maybe I can ask him to respond to  
10 that.

11 MR. JOHANSEN: A. In my direct evidence,  
12 which in turn was a simplified version of the plan  
13 information, which is included in the document which I  
14 have referred to previously, radioactive materials  
15 management at Ontario Hydro, the plan for used fuel, it  
16 was issued in 1991 and is our current plan in these  
17 matters, and that was a document provided in response  
18 to Interrogatory 9.41.6, and it may have a number  
19 already.

20 THE CHAIRMAN: Why don't we proceed.

21 THE REGISTRAR: 9.41.6 is 520.20.

22 THE CHAIRMAN: Thank you.

23 MR. JOHANSEN: Thank you, Mr. Lucas.

24 MR. MONDROW: Q. Is there a date in that  
25 document?

1 MR. JOHANSEN: A. On page 21 of that  
2 document is a time line of major activities from the  
3 present through to the planned or assumed in-service  
4 date of 2025, and I can give you from that the dates  
5 for commencing any major activity that you would like.

6 You are talking about the date for a  
7 commencement of site characterization, was it?

8 Q. That's right. I have the date of  
9 2003.

10 A. Yes. According to this general  
11 schedule, the indication is that beyond about the year  
12 2005, site selection and facility design would begin,  
13 so we are not far out. And there are uncertainties  
14 about those dates of course.

15 Q. Yes.

16 A. But for planning purposes, your  
17 assumption is not far off.

18 Q. Again, I am trying to get just a  
19 rough picture of the history here, and I will leave it  
20 after this point.

21 With the disposal concept project it was  
22 a little difficult to identify dates akin to the  
23 announcement or commitment dates for the facilities  
24 because there is a different critical path for that  
25 project, but would you agree that it is fair that the



1 2003 date, or a date in that area is analogous to the  
2 start dates that I have plotted here for the major  
3 generating facilities?

4 A. Well, I am not sure that they are  
5 exactly analogous.

6 All I could say is that around the year  
7 2005, subject to the sort of uncertainties that we have  
8 discussed, given that this is, after all, sometime in  
9 the future, and a major review of the concept still to  
10 be completed, is a reasonable milestone date to assume  
11 for general planning purposes.

12 That's about all I can say.

13 Q. And that's when hopefully work will  
14 be started on actually siting the disposal facility,  
15 actually figuring out where it will go and --

16 A. That is when site selection and  
17 facility design would commence.

18 Q. Thank you. Mr. Penn, from my reading  
19 in the area I get the sense that the political  
20 environment for and the social attitudes towards  
21 nuclear power have been worsening over the last decade  
22 or so. Would you say that's a fair statement?

23 MR. PENN: A. Well, I think it is a very  
24 generalized statement. Are you talking about in  
25 Ontario?



1 Q. No. The world situation.

2 A. In France, in Japan, and some other  
3 areas, particularly in Korea, Taiwan, I would say that  
4 it has grown in support.

5 In other countries, such as Germany,  
6 Sweden, Switzerland, Italy, it has declined.

7 Q. Mr. Penn, could you turn to Exhibit  
8 526, please. This was the nuclear sector focus report  
9 filed by AECL.

10 You will recall at that time I think you  
11 went through the table at page C-18 with Mr. Heintzman,  
12 or the graph, rather. In fact, I think you revisited  
13 that graph with Mr. Poch briefly, so I am not going to  
14 look at it again, but I would like you to flip forward  
15 a couple of pages, I will just find my reference here,  
16 to page C-21, please.

17 A. Did you have a comment on C-18?

18 Q. No. I was just orienting us.

19 So on page C-21 we see a heading nuclear  
20 reactor orders. You have that? Heading No. 5?

21 A. Yes, I have got that.

22 Q. At the bottom of the page?

23 A. Yes.

24 Q. The first sentence of that paragraph  
25 describes a decline from 1988 to 1989 in the world-wide

1 market, and giving the heading of that section I assume  
2 that's the world-wide market for nuclear reactor  
3 orders.

4 DR. CONNELL: Mr. Mondrow, if you want to  
5 engage my attention in this, you have to give me a  
6 minute.

7 MR. MONDROW: I'm sorry. Perhaps we can  
8 just pause for a minute.

9 Q. Mr. Penn, I was saying that the first  
10 sentence of the paragraph under heading 5 describes a  
11 decline from 1988 to 1989 in the world-wide market, and  
12 I assume that's the world-wide market for nuclear  
13 reactor orders.

14 Do you disagree with that statement?

15 MR. PENN: A. It appears to be that.

16 As I mentioned I think when Mr. Heintzman  
17 first introduced this document, I have not read it  
18 before this time, so I don't know the context of some  
19 of these remarks.

20 Q. Do you disagree from your knowledge  
21 with the statement that the world-wide market for  
22 nuclear reactor orders has declined?

23 A. No, I don't disagree.

24 Q. And the third sentence talks about in  
25 fact a 50 per cent decline in the 7-year average over

1 the last 14 years. Do you a disagree with that  
2 statement? This is at the bottom of page C-21.

3 A. I don't see any reference to 50 per  
4 cent.

5 Q. If we just look the a sentence. It  
6 says the average yearly total between 1975 and 1981 was  
7 18,655 megawatts electrical. And during the past seven  
8 years the average was 9,325 megawatts electrical. That  
9 seems to indicate to me about 50 per cent decline  
10 between the first seven year period and the second  
11 seven year period.

12 THE CHAIRMAN: That's quite right but one  
13 of the problems with this, it would be must easier if  
14 you referred to the actual figures. When you refer to  
15 50 per cent I look for 50 per cent and I don't see it.  
16 So it's a little hard.

17 MR. MONDROW: I understand Mr. Chairman.  
18 I will try to do that. I have perhaps jumped ahead a  
19 little.

20 THE CHAIRMAN: It's quite all right to  
21 then following on to confirm that that is 50 per cent  
22 as it seems to be.

23 MR. MONDROW: It would certainly assist  
24 everybody if I outline my thought process.

25 Q. Do you agree that that's what that

1 sentence indicates, Mr. Penn, a 50 per cent decline  
2 over those two time periods for nuclear reactor orders?

3 MR. PENN: A. That's what it says, yes.

4 [12:00 p.m.]

5 Q. And if you turn over to the next  
6 page, C-22, there is a plot there of nuclear worldwide  
7 contract awards, and it is plotted from 1972 through  
8 1989, and the graph shows a marked decline.

9 Do you agree, Mr. Penn, that this graph,  
10 this marked decline, is indicative of the market trend  
11 for nuclear reactors?

12 A. That is what the graph shows. I have  
13 no way of vouching for the accuracy of it.

14 Q. Mr. Penn, you have had extensive  
15 experiences. I am asking for your evidence. Do you  
16 agree that there has been a worldwide market trend  
17 decrease as indicated by this graph in your experience?

18 A. I have already said I do. All I have  
19 mentioned was I can't vouch for the exact accuracy on  
20 this figure 4.

21 Q. That's fair. Thank you. If you  
22 could turn back to Exhibit 647, please. Pages 2 and 3  
23 are the title page from the Nuclear Energy Agency of  
24 the OECD and an excerpt from their 1991 report, Nuclear  
25 Energy Data.

1                   The excerpted page at page 3 of the  
2       exhibit is a table. The heading of the table is The  
3       Status of Nuclear Power Reactors, as of December 31st,  
4       1990, and looking across the top of the table you can  
5       see column headings for Connected to the Grid, Under  
6       Construction, Firmly Committed, and Planned.

7                   Are you with me, Mr. Penn, so far?

8                   A. Yes, I see that.

9                   Q. Thank you. Under the second column,  
10      Under Construction, we see 23 plants. Those would have  
11      been committed some years ago, is that fair, if they  
12      are under construction now?

13                  A. They would be committed previously,  
14      yes.

15                  Q. And if you move to the Firmly  
16      Committed column I see all zeros in that column  
17      except -- and you have mentioned Japan. There are  
18      three. So that means that in all OECD countries there  
19      are currently three firmly committed nuclear plants?

20                  A. Well, unfortunately, I don't know  
21      what the definition of firmly committed means. I don't  
22      know as of what date.

23                  DR. CONNELL: Could we clarify, there is  
24      a distinction between plant and reactor. Which is it?

25                  MR. MONDROW: I think, sir, that it is



1 reactor because Canada has 20, so I would assume that  
2 that would be reactor units.

3 DR. CONNELL: Thank you.

4 MR. MONDROW: Q. Now, the last column,  
5 Mr. Penn, shows in fact 21 plants planned, and I see  
6 that 9 are in Canada so we should subtract at least 2,  
7 I guess, from that number, or maybe 4, depending on  
8 what information Ontario Hydro provided for the  
9 compilation of this table.

10 Do you know by any chance how many we  
11 should subtract from the number 9 in that column, what  
12 this number was based on.

13 DR. CONNELL: You said plants again, Mr.  
14 Mondrow.

15 MR. MONDROW: I'm sorry, sir.

16 DR. CONNELL: Did you mean reactor units?

17 MR. MONDROW: I think reactors.

18 MR. PENN: Well, I presume with the  
19 Exhibit 452 Update that Ontario Hydro has not plans at  
20 the moment for any.

21 MR. MONDROW: Q. And this would have  
22 been compiled before the Update, and as Dr. Connell has  
23 pointed out, I guess we are talking about reactors so  
24 the number is --

25 MR. PENN: A. Obviously. It is dated,



1 according to this table, 31st of December, 1990.

2 Q. Yes.

3 A. But as I gave in my direct evidence,  
4 this table is not up-to-date. There are, I indicated  
5 in my evidence or cross-examination, plans in Finland,  
6 plans in France, new plans in Japan, and initiatives in  
7 the United States, not to say anything about Taiwan and  
8 Korea, other countries.

9 Q. My understanding with the United  
10 States is that since 1978 there haven't been any new  
11 reactor orders, and, in fact, I think you testified to  
12 that earlier; is that correct?

13 A. That's correct. But I also testified  
14 that the United States is supported by the Department  
15 of Energy and major utilities in the United States, and  
16 major industry is spending currently \$500 million on  
17 designing plant.

18 Q. And this is the evolutionary reactor  
19 designing program that you spoke of?

20 A. This is the advanced light water  
21 reactors, yes.

22 Q. In fact, in terms of existing nuclear  
23 reactors U.S. utilities are shutting down a good number  
24 of their existing reactors, some of which haven't even  
25 gone critical; is that correct?

1                   A. I can't tell you whether they are  
2                   shutting down reactors that haven't gone critical, but  
3                   they are certainly considering shutting down older and  
4                   smaller plants.

5                   Q. There is the Shoreham facility in New  
6                   York for which the Long Island Power Authority has  
7                   issued a request for proposals to convert the building  
8                   that has already been built to a gas-fired plant. Do  
9                   you have any of knowledge of that situation?

10                  A. Well, I know that the Shoreham plant  
11                  was subject to significant opposition and litigation  
12                  over years. I don't know what the utility's plans are  
13                  for that, that plant.

14                  Q. Do you know, Mr. Penn, whether it  
15                  will be built as a nuclear plant or not?

16                  A. I really don't know anything about  
17                  it. I only gather that it probably won't.

18                  Q. And there are some reactors that have  
19                  been running, as you say, some of which are being shut  
20                  down early. There is the San Onofre plant. I forget  
21                  the full name. San Onofre Nuclear Generating Station,  
22                  or SONGS 1, which we will come back to when we get to  
23                  Exhibit 521. But your information is that that is  
24                  correct, that plant is to be shut down; is that right?

25                  A. Yes, it is. And there is also

1 information on the record at this hearing that the  
2 output from nuclear plant in the U.S. has increased in  
3 recent years and some exceptionally high records of  
4 output from United States plants, typically those owned  
5 by Duke Power and those owned by Arizona Power.

6 Q. And just to balance that picture I am  
7 going to ask you about a couple of other facilities for  
8 which the situation isn't as bright. The Yankee Rowe  
9 facility was shut down in September 1991. It had  
10 operated for 30 years, and I understand the utilities  
11 that owned that facility have concluded as of February,  
12 '92 that the shutdown will be permanent.

13 Are you aware of that situation?

14 A. We testified earlier in this hearing  
15 on Yankee Rowe. It is a small plant, I think it is  
16 about 180 megawatts, and that particular utility which  
17 I think is Upper New York State, has other power  
18 sources that are clearly more economic.

19 Q. 1989, Sacramento voters turned off  
20 their Rancho - I think it is - Seco reactor after 15  
21 years of operation.

22 Do you know about that situation?

23 A. Again, we gave evidence on that  
24 subject earlier.

25 Q. Just to generalize here, then, I have

1 read that over 1000 U.S. nuclear plants were abandoned  
2 during construction in the 70s and the 80s due to cost.

3 Can you comment on that, Mr. Penn?

4 A. No, I can't.

5 Q. You have no knowledge of that  
6 situation?

7 A. I don't have that sort of statistics  
8 in my head.

9 Q. Would you say that is a fair static?  
10 Does that surprise you, that statistic?

11 . A. I know that a number of utilities did  
12 change their plans.

13 Q. The statistic 100 U.S. nuclear  
14 plants, does that number surprise you?

15 A. I can't comment on the number.

16 Q. Ms. McClenaghan took you through the  
17 rest of the world, and I am not going to repeat that,  
18 but I wanted to ask you about the UK situation.

19 The UK, of course, has decided to  
20 privatize its generation, including nuclear, only you  
21 can't get the private sector interested. In fact, you  
22 have already commented on this in discussions with Ms.  
23 McClenaghan that:

24 The private sector demands a different  
25 sort of economics than does a public

1 utility. It is my understanding that  
2 under scrutiny, under scrutiny by the  
3 private sector that it has come to light  
4 that the public utilities in the UK have  
5 significantly understated, and some  
6 allege deliberately, the costs of their  
7 nuclear program.

8 Are you aware of those revelations, Mr. Penn?

9 A. Well, I am quite aware of the United  
10 Kingdom program, and you have given a picture which is  
11 misleading.

12 Q. Could you clarify for us, please?

13 A. Absolutely. One of the key issues  
14 that I mentioned in my evidence is that it was not  
15 possible in the United Kingdom for a private utility to  
16 secure a contract that would extend 30 or 40 years into  
17 the future. When you have a situation like exists in  
18 France and here in Ontario where we have a public  
19 utility that generates power at cost, then there is no  
20 issue with regard to the certainty of the sale of  
21 power, and therefore --

22 Q. Just to interrupt you for one minute.

23 A. And therefore --

24 MR. B. CAMPBELL: Could he finish the  
25 answer, please?



1 MR. MONDROW: Q. Go ahead, please.

2 MR. PENN: A. And this is only one small  
3 issue in the United Kingdom situation, that as you know  
4 went on in a hearing for more than 2-1/2 years.

5 And therefore, it was necessary to  
6 depreciate the plants over a period of 20 years rather  
7 than as long as 30 or 40 years, and that clearly  
8 changed the economic rules and affected the cost as a  
9 result of those rule changes.

10 Q. You testified, Mr. Penn, that Lord  
11 Marshall, Chair of the British Central Electricity  
12 Generation Board testified in those hearings. Isn't it  
13 true that in fact Lord Marshall resigned over those  
14 matters?

15 A. I have no idea why Lord Marshall  
16 resigned. Lord Marshall is a very eminent person in  
17 Britain, held the chairmanship of CEGB for many years,  
18 was very close to the government in Britain. I think  
19 you would have to ask Lord Marshall why he resigned.

20 Q. Well, Mr. Penn, there has been quite  
21 a political uproar about the situation. You have been  
22 aware of that, have you not? In fact, Prime Minister  
23 Thatcher publicly apologized for the financial  
24 disclosure fiasco; isn't that true?

25 A. I don't know what you are talking



1 about.

2 Q. Are you aware that in Ontario  
3 non-utility generators get 30 year contracts and they  
4 seem to do fine by them?

5 A. I didn't hear what you said. Could  
6 you repeat?

7 Q. Non-utility generators in Ontario  
8 work on 30 year contracts and they seem to be doing  
9 quite well with them. Earlier you mentioned that the  
10 private sector has different economic needs and it  
11 wasn't necessarily indicative of the fact that nuclear  
12 generation was uneconomic, that the private sector  
13 wasn't interested in the UK nuclear facilities?

14 A. As far as I understand it, and this  
15 is an issue that I'm sure was discussed at length by  
16 the non-utility generation panel whose number I don't  
17 recall, but --

18 Q. It was Panel 5.

19 A. Panel 5. Thank you. I think until  
20 recently there has been very little non-utility  
21 generation in this province, and I am not familiar with  
22 these long-term contracts that you are speaking of and  
23 how long they have gone on for yet.

24 Q. Certainly not your area.

25 A. No.

1                   Q. You mentioned France a few minutes  
2 ago. I would like to talk about France. You testified  
3 that France has perhaps the most well established  
4 nuclear system in the world. Do you recall that  
5 testimony, that they have been very successful?

6                   A. They have the largest nuclear program  
7 relative to the electricity generated in the world,  
8 yes.

9                   Q. And your testimony is that their  
10 program has been very successful?

11                  A. I think it is generally recognized  
12 throughout the world that it has been.

13                  Q. And do you think that today the  
14 French nuclear industry is still very successful, it is  
15 in a healthy condition?

16                  A. Well, I was there recently in January  
17 and spoke with senior officials in the EDF and  
18 Framatome and NEI and other companies, and there was no  
19 question that in concert with reduced economic growth  
20 throughout the world, at least in the developed world,  
21 the number of commitments in France has slowed.

22                  But I didn't detect any particular  
23 serious pessimism for the future. France has just  
24 taken a significant advantage with Germany in forming a  
25 new company combining the strengths of Siemen's and

1 Framatome.

2 Q. Could you turn up --

3 A. I don't think they would do that for  
4 no good reason.

5 Q. They would certainly like to keep  
6 building them, I'm sure. I would agree with you there.

7 Could you turn up Exhibit 647 at page 4,  
8 please? This is a short article from the February,  
9 1991 Economist about the French nuclear situation.

10 If you look at the first page, please, in  
11 the middle column near the bottom, it is actually the  
12 last sentence of the last full paragraph in that middle  
13 column. It says:

14 Competition from home or abroad will  
15 expose the inefficiency of France's  
16 nuclear industry which have been hidden  
17 for years by a lack of clear cost  
18 accounting and the government's  
19 unquestioning support.

20 Do you think that statement is true, Mr. Penn?

21 A. Well, I have no basis for comment. I  
22 don't know whether this is an editorial or who wrote  
23 it. I see it appeared in the Economist in February of  
24 1991. I don't have any basis for comment on that  
25 sentence.

1 Q. In this hearing we are just using  
2 articles like this to elicit your opinion. So I would  
3 like to ask you, in your opinion and based on the  
4 visits that you have just testified you had in France  
5 with the people there doing nuclear generation, do you  
6 think that statement is true?

7 MR. B. CAMPBELL: Well, Mr. Chairman,  
8 hasn't the witness stated that he has no basis for  
9 comment? In my submission, that should be the end of  
10 it.

11 What is said here is that something has  
12 been hidden for years by a lack of clear cost  
13 accounting and the government's unquestioning support.  
14 I don't know how, in light of Mr. Penn's answer to,  
15 that he can be now asked to comment. He has said he  
16 has no basis to provide any comment on that, and I  
17 think he has spoken to the matters on which he did gain  
18 a generally understanding on his visits. Obviously,  
19 this is not one of them.

20 MR. MONDROW: Mr. Chairman, Mr. Penn has  
21 just told us that he has just visited France in the  
22 recent past and he has discussed their nuclear program.  
23 If Mr. Penn doesn't think that that statement is true,  
24 then I am happy to have that answer.

25 The statement talks about the

1 inefficiencies of France's nuclear industry and the  
2 lack of clear cost accounting. I would like to get Mr.  
3 Penn's answer on that.

4 THE CHAIRMAN: He cannot say it is true  
5 or not, but if he can add any comment he wants to make  
6 on it, he can make it.

7 MR. PENN: Well, all I can say, Mr.  
8 Chairman, is that I'm not aware of, nor was any  
9 discussion held with me with very senior officials I  
10 met with, with regard to competition from home or  
11 abroad to EDF to construct generating stations, for  
12 example.

13 So I don't think there is any basis  
14 whatsoever for the opening part of that sentence.  
15 Therefore, I don't see how that could expose any  
16 inefficiencies of France's nuclear industry.

17 The industry we are talking about is  
18 Framatome and Alstrom. Alstrom is one of the largest  
19 companies in the world involved in designing and  
20 building steam turbines and generators. I detected no  
21 inefficiency in that company. And I have no idea what  
22 the basis of this article is for commenting on the  
23 relationship presumably between EDF and the government  
24 with regard to their cost accounting of their  
25 generating program. That is all I can say about it.



1 MR. MONDROW: Q. Mr. Penn, I take it you  
2 don't agree that the French nuclear system is  
3 inefficient?

4 MR. PENN: A. I think it is well known  
5 in the world that France has engineered an excellent  
6 product based on a license originally from the United  
7 States from Westinghouse and actually sells 17 per cent  
8 of its power from these plants to all neighbouring  
9 European countries, including the United Kingdom. That  
10 is one of the reasons why the electricity rates in  
11 France have been quite moderate.

12 MR. DALY: A. I would just like to add  
13 one point to Mr. Penn's remarks about EDF.

14 Q. Please.

15 A. One of the major benefits from the  
16 program has been that the sulphur dioxide emissions  
17 from the fossil plants have been cut by a factor of 10  
18 between 1980 and 1987. So I think when we are looking  
19 at EDF we should take into account not just the cost  
20 factors but the environmental benefits from that.

21 [12:20 p.m.]

22 MR. PENN: A. If I could add a little  
23 more to that, in fact, EDF told me only recently, in  
24 January, and they were quite proud of it, I think, that  
25 they were the only major country in the world that



1 actually had been reducing carbon dioxide emissions and  
2 SO(2) emissions and NOx into their environment.

3 Q. Indeed, France is very committed to  
4 nuclear power. Do you agree with that, Mr. Penn?

5 A. Yes, and there's a very good reason.  
6 France, perhaps similar to Japan, has no indigenous  
7 oil, no indigenous natural gas, no indigenous coal of  
8 real note. And the Government of France made a  
9 decision many, many years ago that if they are going to  
10 be independent of others for energy supply, that the  
11 nuclear program was their best solution.

12 Q. In the third column of this page 4  
13 the author states at the bottom of the column, "The  
14 plain fact is that EDF cannot afford more reactors  
15 without being bailed out by the government."

16 Mr. Penn, when you were in France, you  
17 didn't get any sense that EDF was in financial straits?

18 A. There was no discussion in my  
19 presence about their financial decision.

20 Q. I have one more question, please, on  
21 page 5 of my exhibit. In the third column neither top,  
22 second sentence.

23 Last year EDF announced that it would  
24 convert one of its oldest nuclear  
25 stations to run on natural gas. Sources

1 within EDF say that gas could well  
2 replace more of the company's nuclear  
3 capacity.

4 Do you have any knowledge of that  
5 situation from your discussions, Mr. Penn?

6 A. No, I don't. And I can't imagine,  
7 for the reasons that I have just given you, if they  
8 used massive amounts of natural gas they would have to  
9 pipe it from Russia or Poland, and they would be very  
10 vulnerable.

11 Q. Mr. Penn, could you turn up, please,  
12 Exhibit 522. This is the brief from the Canadian  
13 Nuclear Association dated October, 1991, to the  
14 Standing Committee on Energy Mines and Resources.

15 Mr. Penn, were you familiar with this  
16 document before?

17 THE CHAIRMAN: What number is it?

18 MR. MONDROW: I'm sorry, Mr. Chairman.  
19 Exhibit 522.

20 Q. Mr. Penn, were you familiar with this  
21 document before it was filed?

22 MR. PENN: A. No, I wasn't. I've read  
23 it since you have provided it to us.

24 Q. Was anyone else on the panel familiar  
25 with this document before we filed it? I don't hear

1 any answers. I take that as a no.

2 Mr. Penn, do you know, as one of the key  
3 members of the Canadian Nuclear Association, did  
4 Ontario Hydro at any level have any input into this  
5 document?

6 A. I don't know.

7 Q. Does the CNA, do you know, generally  
8 get input from its most active members when making  
9 submissions to the government?

10 A. I could add, and just backing up on  
11 the previous question, I notice this is dated October,  
12 1991. And the only senior person in Ontario Hydro that  
13 was associated with the executive of the CNA was Mr.  
14 Bartholomew, who, of course, unfortunately, through  
15 illness has had to retire some considerable time ago.  
16 And I doubt very much whether, therefore, Hydro had any  
17 input into this document.

18 Q. I'm sorry. Had Mr. Bartholomew  
19 retired previous to the October, 1991, date?

20 A. He retired, unfortunately, with  
21 serious illness in the spring or summer of 1991.

22 Q. And so Ontario Hydro had no liaison  
23 with the Canadian Nuclear Association following Mr.  
24 Bartholomew's sickness and retirement?

25 A. I don't have knowledge of it. I'm

1 just mentioning that I presume a brief of this nature  
2 to a Standing Committee on Energy Mines and Resources  
3 would be the result of a review by the executive of the  
4 CNA.

5 Q. And Mr. Bartholomew was the only  
6 person in Ontario Hydro who dealt with the CNA  
7 executive?

8 A. He was the only senior member that  
9 I'm aware of as a director of the CNA at that time.

10 Q. You haven't replaced Mr. Bartholomew  
11 with anybody? Does he have any staff that he works  
12 with?

13 A. Not that I'm aware of, no.

14 Q. And you haven't replaced him with  
15 anybody.

16 A. I don't think so. I recall, I think  
17 it was Mr. Poch, bringing up the question about a  
18 letter from the Minister, Mr. Ferguson, to our  
19 chairman, Mr. Eliesen, indicating that Ontario Hydro  
20 would not be a member of the CNA.

21 Q. Well, I think the letter spoke about  
22 contributions towards the public information--

23 A. It spoke...

24 Q. --a function of the CNA. Excuse me,  
25 I'll just finish my question. But if I recall

1 correctly, the contributions were divided into two  
2 segments. There was membership and public information.

3 And your testimony, I believe, was that  
4 as with other energy organizations, Ontario Hydro is a  
5 member of the CNA in order to keep its finger, as it  
6 were, on the pulse of energy developments. Do you  
7 recall that testimony?

8 A. I recall saying why Ontario Hydro had  
9 been a member of the CNA. And I think we would have to  
10 turn up the Minister's letter. But it seemed to me  
11 pretty clear that it was a request neither to pay  
12 membership nor to support information programs.

13 Q. So your information is that currently  
14 Ontario Hydro is not a member of the CNA.

15 A. As far as I know. I don't know for  
16 sure. But as I testified earlier, I could hardly  
17 expect that the chairman would not take notice of the  
18 Minister's request.

19 Q. Certainly.

20 A. I think you should ask our chairman.

21 Q. Well, if he were here I probably  
22 would. But I'll do my best asking those of you who are  
23 here.

24 I would like to take you, then, for a few  
25 minutes and go through this brief. Throughout the



1       excise I'm going to put some statements to you from the  
2       brief, and I would like you, please, to respond as to  
3       - whether you agree or disagree, and I'm happy to hear  
4       any comments you have in addition to that, of course,  
5       following that agreement or disagreement.

6                       Some of these issues have been canvassed,  
7       and I won't spend a lot of time repeating, but I'll ask  
8       you to bear with me because I would like to get your  
9       reaction to the statements as expressed in this  
10      document. And if you have discussed them at length, it  
11      shouldn't be necessary to spend a lot of time on it.

12                      I think the most efficient way to do that  
13      is probably to start at the executive summary, which is  
14      at page 2. The first bullet there says that

15                      Worldwide requirements for electricity  
16                      are increasing and forcing utilities to  
17                      develop generating facilities that  
18                      provide a greater respect for the  
19                      environment.

20                      Mr. Penn, would you agree with that  
21      statement?

22                      A. Yes.

23                      Q. The first sentence of the second  
24      bullet says that electricity production from nuclear  
25      power has a very low environmental impact when compared



1 to other methods. Would you agree with that statement?

2 A. I think it's generally true. And I  
3 might preface that I am making personal comments.

4 Q. Well, Mr. Penn, I'm going to ask you  
5 to speak on behalf of Ontario Hydro, please, in  
6 addition to your personal comments.

7 A. I'm not sure that I'm familiar with  
8 the policy of Ontario Hydro on possibly all these  
9 issues.

10 Q. Perhaps we can take it issue by  
11 issue. But you are here as a witness for Ontario  
12 Hydro. So on that issue, "Electricity production from  
13 nuclear power has a very low environmental impact when  
14 compared to other methods." Speaking for Ontario  
15 Hydro, would you agree with that statement?

16 A. I just answered the question.

17 Q. Speaking personally, would you agree  
18 with that statement?

19 A. Yes.

20 Q. I suppose we should ask Panel 10 to  
21 comment on that statement? Is that a planning issue,  
22 do you think?

23 MR. B. CAMPBELL: Well, we have given  
24 evidence on the environmental effect or environmental  
25 characteristics associated with the variety of options.

1 And how those are traded off in planning will  
2 definitely be dealt with in Panel 10.

3 MR. MONDROW: Q. The next sentence in  
4 the second bullet, Mr. Penn, states that "Nuclear  
5 energy is an increasing realistic choice based on  
6 environmental and economic criteria."

7 Can you comment from Ontario Hydro's  
8 perspective on that statement?

9 MR. PENN: A. Well, I think it's just an  
10 opinion of the Canadian Nuclear Association.

11 Q. Mr. Penn, your evidence has been that  
12 nuclear generation is economic. Do you agree with that  
13 statement? It's cost-effective?

14 A. I've given evidence with respect to  
15 the generation of electricity in Ontario.

16 Q. Yes.

17 A. On what the economics are of the  
18 existing nuclear program. And I think in Exhibit 519,  
19 and page 73, I believe it clearly demonstrates the  
20 economics of our nuclear power system.

21 Q. I will take that as a yes, you  
22 believe that nuclear power is economic in Ontario.

23 A. I have every reason to believe it  
24 will be in the future, and I certainly know it has been  
25 in the past.

1 Q. Fair enough. Would you agree, then,  
2 with the segment of that bullet that I was referring to  
3 that it is increasingly realistic as an option in  
4 Ontario?

5 A. Well, I think this is a planning  
6 matter. And Ontario Hydro, in providing the Update  
7 Plan Exhibit 452 has clearly stated what its choices  
8 for the future are.

9 Q. And you have just commented a minute  
10 ago, Mr. Penn, that nuclear generation would certainly  
11 be economic in the future. So I take it that you would  
12 agree.

13 A. I said I had every reason to believe  
14 it would be.

15 Q. Okay. Thank you. Third bullet,  
16 then, on the page. It says that "Canada has impeccable  
17 credentials in the nuclear industry." And it cites the  
18 CANDU as a strong performer in Canada and  
19 internationally. Would you agree with that statement,  
20 Mr. Penn?

21 [12:30 p.m.]

22 A. Yes.

23 Q. The fourth bullet is probably  
24 something that you can't comment on, so I will ask you  
25 to skip to the second last bullet on the page, that

1       says:

2                   Public acceptance of nuclear energy is  
3                   increasing. People are wary of the  
4                   nuclear industry's ability to handle its  
5                   waste, but they respect the option.

6                   Do you agree with that same, Mr. Penn?

7                   A. I am not sure that I can agree with  
8                   the fact that it says public acceptance of nuclear  
9                   energy is increasing.

10                  I think, although I am not a pollster,  
11                  and I don't follow it very closely, but I think that  
12                  you will see that people's opinions on all sorts of  
13                  issue, and particularly nuclear energy, depends upon  
14                  the issues of the day, wax and wane.

15                  I think it is correct that people have  
16                  concern - I don't know if I have used the word "wary" -  
17                  citizens have concern for handling nuclear waste, and  
18                  they are a considerable number of people in our society  
19                  who respect the option.

20                  Q. Thank you. Turning over to page 3,  
21                  please. The CNA offered some recommendations to the  
22                  Energy, Mines and Resources Standing Committee, and at  
23                  the first bullet we see the recommendation to continue  
24                  to publicly sort the Canadian nuclear option.

25                  Do you agree with that statement, Mr.

1 Penn?

2 A. Well --

3 Q. Excuse me. Would you agree with that  
4 recommendation?

5 A. Well, I take it to be a request of  
6 the Canadian Nuclear Association of the Standing  
7 Committee, and therefore to the government, for  
8 continued public support of the option.

9 Q. Yes. And speaking for Ontario Hydro,  
10 would you support that recommendation?

11 A. Yes, as I would supporting any  
12 successful technology in Canada.

13 Q. The second bullet recommends the  
14 maintenance of the Atomic Energy Control Board as a  
15 strong regulatory authority that would ensure that  
16 public concerns about nuclear generation of electricity  
17 are addressed.

18 Speaking for Ontario Hydro, would you  
19 agree with that recommendation?

20 MR. B. CAMPBELL: Just a minute.

21 Mr. Chairman, in all of these I am not  
22 aware, and I think if we are going to ask Mr. Penn to  
23 speak on behalf of Ontario Hydro as to whether the  
24 particular recommendations are supported by Ontario  
25 Hydro, in my submission, there has somebody some



1       groundwork laid by my friend as to whether to Mr.  
2       Penn's knowledge these matters have been considered at  
3       a senior level of Ontario Hydro, if he is asking those  
4       specific questions, and he has not done so.

5                 Without that, in my submission, my friend  
6       can explore Mr. Penn's view but I am not aware as to  
7       whether or not these have been considered and I am not  
8       aware of whether Mr. Penn is or is not.

9                 In my submission, if we are going to ask  
10      for that kind of question there needs to be the proper  
11      groundwork laid.

12                MR. MONDROW: Mr. Chairman, I am asking  
13      Mr. Penn for his comments on the excerpts from this  
14      document as it has been our practice in this hearing to  
15      do with materials filed that aren't Ontario Hydro  
16      documents, and I would simply like to get his response,  
17      speaking for Ontario Hydro, on whether Ontario Hydro --

18                THE CHAIRMAN: But this a recommendation  
19      that the federal government should take some policy  
20      move. If Ontario Hydro hasn't considered that or  
21      hasn't made that recommendation, then presumably it's  
22      not something that they are prepared to express an  
23      opinion on at this time.

24                I think you can ask him - I don't know  
25      are why you are doing it, quite frankly - but if you



1 want to ask him about the accuracy of certain  
2 statements or his opinion on certain opinions that are  
3 given, that's fine. But I think when you get into the  
4 area of what the proponent is recommending to another  
5 government, the Federal Government of Canada, on this  
6 issue, I am not sure what help that is to me.

7 MR. MONDROW: Q. Mr. Penn, the next  
8 bullet on the page recommends a full review of the  
9 waste management concept by the Federal Environmental  
10 Assessment Board.

11 Is that something that Ontario Hydro  
12 would like to see?

13 MR. PENN: A. Well, I can say I believe  
14 that Ontario Hydro fully supports a full review of the  
15 waste management concept by the environmental  
16 assessment review office.

17 Q. The next bullet recommends continued  
18 government support for a nuclear research and  
19 development.

20 Is that something that Ontario Hydro  
21 would like to see?

22 The next bullet says:

23 Continue to ensure that the national  
24 nuclear R&D program is adequately funded.

25 Is that something that Ontario Hydro

1 would like to see?

2 A. Well, I can only repeat again as I  
3 did at the start of this cross-examination, that I do  
4 not know what the stated policy of the board of  
5 directors of Ontario Hydro are on all these matters at  
6 this time.

7 Now having said that, Ontario Hydro for  
8 the purposes of ensuring the continuous and improved  
9 performance of its nuclear plants certainly does  
10 support research and development specifically aimed at  
11 those plants today.

12 Q. Perhaps, Mr. Penn, it would be a bit  
13 easier if I prefaced my comments generally this way, I  
14 won't ask you to tell me whether Ontario Hydro as an  
15 official policy decision is supporting or not  
16 recommendations. What I will ask you for is your  
17 testimony on behalf of Ontario Hydro, which is why all  
18 you gentlemen are here, whether you would like to see  
19 the recommendations followed through with. Is that  
20 fair? Whether that's something Ontario Hydro would  
21 like to say, as you have just answered.

22 MR. B. CAMPBELL: Well, Mr. Chairman, in  
23 my submission, it's just exactly the same question,  
24 it's stating it differently.

25 I make exactly the same point. There are

1 a variety of matters here, many of which may never have  
2 been considered at a senior decision-making level at  
3 Ontario Hydro.

4 It doesn't matter how my friend prefaces  
5 the question, if what is asking for is an answer that  
6 is Ontario Hydro's view of a particular matter, if it  
7 hasn't been considered in the way it's stated here, and  
8 it is stated in many case very particularly, it hasn't  
9 been dealt with in the way it's stated here, and the  
10 witnesses are knowledgeable people in their area and  
11 the Board has permitted their answers to be given in  
12 that area, but I do not think it is --

13 My friend has to, if he wants to take the  
14 answer as representing a considered Ontario Hydro view,  
15 then he has to establish that in fact the precise  
16 question that he is dealing with has in fact been  
17 considered at an appropriate level at Hydro.  
18 Otherwise, he has the view of people who are experts in  
19 their particular areas and what their opinion is based  
20 on their experience.

21 THE CHAIRMAN: I don't think putting a  
22 blanket caveat on top of all the questions, because we  
23 don't know what the questions are and what areas they  
24 cover.

25 MR. MONDROW: Fair enough, Mr. Chairman.

1 I will try to deal with it question by question.

2 Q. I will phrase my question  
3 appropriately, Mr. Penn, so that you won't be put in a  
4 situation that you would not like to comment on, not  
5 being able to speak for Ontario Hydro's policies.

6 If we could continue on, and I will try  
7 this, please. The next bullet recommends the continued  
8 investment in the construction and demonstration of a  
9 second generation nuclear system, including CANDU 3.

10 Speaking for the nuclear generation  
11 people at Ontario Hydro is that something that you  
12 would like to see, Mr. Penn?

13 MR. PENN: A. As far I understand it,  
14 the Canadian Nuclear Association is asking the federal  
15 government to invest and to allow AECL, in essence, to  
16 develop second generation nuclear systems including  
17 CANDU 3.

18 Now, Ontario Hydro would no doubt benefit  
19 from that continued type of work in its nuclear  
20 program.

21 Q. Fair enough.

22 The seventh bullet recommends  
23 identification and recognition of the contribution  
24 which nuclear energy can make in stabilizing or  
25 reducing carbon dioxide emissions.

1                   Mr. Penn, is that a recognition that  
2           Ontario Hydro feels is warranted?

3                   A. Well, I believe that Exhibit 452  
4           discusses the carbon dioxide emissions resulting from  
5           our proposed plans for the future and points out that,  
6           amongst other things, nuclear energy, since it doesn't  
7           emit carbon dioxide, is one way, if it displaces fuels  
8           that do, as does demand management for example, that  
9           then it's a goal that we are seeking to make.

10                  Q. The next bullet recommends the  
11           establishment of standing environmental assessment  
12           panels to deal expeditiously at the federal level with  
13           requests for approvals for nuclear facilities.

14                  Has that been discussed within Ontario  
15           Hydro, Mr. Penn?

16                  A. Well, it doesn't say for nuclear  
17           facilities. It's a general statement. In my knowledge  
18           it hasn't been discussed in Hydro, but there is no  
19           doubt that we would like to see an efficient process  
20           for the approval of matters involving environmental  
21           assessment.

22                  Q. So in the same vein then, the next  
23           bullet recommends cooperation between the federal and  
24           the provincial governments on environmental assessments  
25           for nuclear facilities.



1 Can I take it from the previous answer  
2 that that's something that Ontario Hydro would like to  
3 see as well?

4 MR. B. CAMPBELL: Where does it say for  
5 nuclear facilities, Mr. Mondrow?

6 MR. MONDROW: Mr. Chairman, I am  
7 apologize, I am not reading verbatim and perhaps I  
8 should.

9 Q. As you mentioned earlier, it doesn't  
10 say for nuclear facilities. I will put it to you  
11 though as a statement with respect to nuclear  
12 facilities, Mr. Penn, and could you answer in that  
13 context, please.

14 MR. PENN: A. Well, the only example  
15 that I can think of at the moment involving nuclear  
16 facilities is the one Mr. Johansen has spoken about at  
17 length, the approval of the concept of used fuel  
18 management. And I believe the Minister's letter that  
19 we looked at earlier today, with Mr. Greenspoon,  
20 clearly indicated that the two ministers wanted an  
21 appropriate role for the provincial governments and the  
22 Ministry of the Environment, and obviously wants to  
23 avoid duplication.

24 Q. The next bullet Mr. Penn, recommends  
25 splitting off approvals into generic and site-specific.



1 it says have two types of environmental assessment, (A)  
2 says generic, and on the second page (B) says  
3 site-specific approvals dealing only with those aspects  
4 of a project which vary from generic standards.

5 In the context of nuclear generation, Mr.  
6 Penn, has that idea been discussed in Ontario Hydro?

7 A. I don't think it's been specifically  
8 discussed with regard to nuclear energy, but I don't  
9 think we would be here today if we weren't looking to  
10 separate the need for a planned undertaking from a  
11 site-specific environmental assessment.

12 Q. Mr. Penn, I would put to you that  
13 there is a distinction between this hearing which has  
14 been coined to be a planning hearing, and for instance  
15 a generic environmental assessment for hydraulic power.  
16 I would put to you that, at least the statement that I  
17 am trying to put to you in this context is for nuclear  
18 facilities, has there been discussion within Ontario  
19 Hydro for having generic environmental assessment  
20 guidelines for nuclear facilities augmented by specific  
21 site hearings for nuclear facilities?

22 A. No, not outside the forum of this  
23 hearing and future site-specific. That has always  
24 been, in my knowledge, the expectation.

25 Q. Thank you. The next bullet on page 4

1 recommends, and it says, I will read it:

2 Delay the implementation of proposed  
3 new, more restrictive worker exposure  
4 limits on uranium mining until an  
5 international protocol, an application is  
6 signed and implemented by all supplier  
7 nations.

8 Is that an issue that has been discussed  
9 in the nuclear generation division of Ontario Hydro?

10 A. Not to my knowledge.

11 Q. Speaking personally, Mr. Penn, is  
12 that something that you would recommend?

13 A. I don't think I would personally know  
14 enough about the concerns and issues to be able to make  
15 an appropriate comment on it. And I don't know what  
16 international protocol is being referred to.

17 Q. Okay. Turning to page 7, please, Mr.  
18 Penn. The last sentence in the first paragraph after  
19 the word "furthermore" says:

20 The technology for long-term  
21 management of radioactive waste is  
22 available.

23 Speaking for Ontario Hydro, do you agree  
24 with that, Mr. Penn?

25 A. I believe, and Mr. Johansen has

1 brought forth a document on numerous occasions, and  
2 maybe you could hand it to me, which is Exhibit 520.20,  
3 which would clearly indicate, I think, that Ontario  
4 Hydro has adopted the nature of the technology that it  
5 favours.

6 Q. The question is: Is the technology  
7 for long-term management of radioactive waste  
8 available? Is it Ontario Hydro's position that that  
9 technology is available?

10 A. The technology is understood. It  
11 depends upon your definition of the word "available".

12 Q. I am happy to have you define it.  
13 You say it's understood.

14 A. That's why Atomic of Canada Limited  
15 as the proponent is about to give very significant  
16 evidence on the technology proposed.

17 Q. Is it available in the sense that you  
18 can go out and acquire it today?

19 A. Well, obviously not.

20 Q. Thank you.

21 A. And our plans don't call for it to be  
22 available until after the turn of the century.

23 Q. Yes, I recall. Thank you.

24 MR. JOHANSEN: A. Mr. Mondrow, I wonder  
25 if I could inject a small point?

1 Q. Please do.

2 A. The statement refers to long-term  
3 management, and I would just add that, as we have  
4 indicated in previous testimony and direct evidence,  
5 Ontario Hydro has available technology to continue  
6 managing the used fuel and other radioactive materials  
7 for a long time, pending the resolution of the question  
8 of the disposal part of long-term management. I think  
9 we have to distinguish between the two.

10 Q. That's fair. And in terms of  
11 managing that waste then the technology is certainly  
12 available. You are using it today?

13 A. Yes.

14 Q. Thank you.

15 The second paragraph on page 7 picks up  
16 the point of economics from the Executive Summary. The  
17 second sentence says that:

18 Nuclear power is less expensive than  
19 burning oil or natural gas in virtually  
20 in ever market.

21 Mr. Penn, is that statement consistent  
22 with your evidence?

23 MR. PENN: A. Yes.

24 Q. And since the paragraph continues:

25 It is also cheaper than coal except in

1 regions close to mines, and it is less  
2 expensive than hydro power except in  
3 markets close to hydro dams.

4 Is that Ontario Hydro's position, Mr.  
5 Penn?

6 [12:50 p.m.]

7 A. Well, it is a general statement which  
8 is true. I don't know whether I would class it as a  
9 position of Ontario Hydro. It is just a question of  
10 fact, that if you built a generating station on top of  
11 a coal mine it would be clearly cheaper.

12 Q. But if you didn't do that nuclear  
13 would be cheaper; isn't that Ontario Hydro's position?

14 A. Well, of course, the paragraph starts  
15 off by talking about nuclear energy as a base load  
16 option, and it is in that context, I believe, that the  
17 rest of this paragraph is commenting on. It is well  
18 known that, certainly in this province, from a base  
19 load point of view that we do not have many  
20 alternatives to nuclear energy and coal.

21 Q. Okay. The next paragraph reads,  
22 second sentence, talks about both nuclear and Hydro  
23 power as: requiring large initial investment, but  
24 offering utilities 40 or more years of relatively low,  
25 inflation-resistant operating expense.



1 I take it from your previous evidence,  
2 Mr. Penn, that you would agree with that statement?

3 A. Well, I don't know about the 40 or  
4 more years yet, but if we took out the "or more years"  
5 I would agree with it.

6 Q. And you would agree with the part of  
7 the sentence that identifies relatively low,  
8 inflation-resistant operating expenses?

9 A. It has been demonstrated.

10 Q. Thank you. Moving on to page 8,  
11 please, the third paragraph touts CANDU as: one of  
12 Canada's few enduring high technology success stories.  
13 The success can be measured by the performance of CANDU  
14 reactors sold whether at home or abroad. And I take it  
15 from your comments earlier this afternoon that you  
16 would agree with that statement, Mr. Penn?

17 A. Well, it will be a sad day when  
18 Canadians aren't proud of their own technology.

19 Q. Indeed. I appreciate that. Moving  
20 on to page 12, please. The last paragraph on that  
21 page - and I am going to paraphrase now - laments the  
22 environmental assessment process and specifically the  
23 amount of funding granted to anti-nuclear intervenors,  
24 which the paragraph fears will result in a danger that  
25 the nuclear manufacturing --



1 THE CHAIRMAN: Hold it. Hold it. What  
2 page are you on?

3 MR. MONDROW: I am on page 12, sir.

4 THE CHAIRMAN: The last paragraph?

5 MR. MONDROW: The last paragraph.  
6 Perhaps I will read it. That might be the easiest way.

7 THE CHAIRMAN: I didn't see any of the  
8 language that you were using.

9 MR. MONDROW: No. I was certainly  
10 paraphrasing, and as you point out, Mr. Chairman,  
11 perhaps I will go right to the paragraph and it will be  
12 easier for everyone to follow.

13 Q. The environmental assessment process  
14 in Ontario has required the utility to  
15 pay massive funding to intervenor groups,  
16 a number of whom oppose the further  
17 development of nuclear energy. The  
18 amount of funding guarantees that process  
19 will be long and protracted, perhaps to  
20 the point of dismantlement of some of the  
21 skilled employee infrastructure in  
22 construction and manufacture of nuclear  
23 equipment.

24 Mr. Penn, can you comment on that  
25 paragraph, please?

1 MR. PENN: A. Well, I can't comment on  
2 behalf of Ontario Hydro on this. I can make a personal  
3 comment.

4 The first thing I have to say is, I am  
5 not sure I understand the law well enough to know  
6 whether it is the environmental assessment process or  
7 whether it is the Intervenor Funding Act that causes  
8 the payment of funding to intervenor groups. I  
9 personally don't find any problem with that. I think  
10 the rest of it is a matter of opinion.

11 Q. You have testified, Mr. Penn, that  
12 there is no danger of the dismantlement of the  
13 infrastructure for nuclear generation in Ontario in the  
14 immediate future because there is a lot of activity and  
15 energy being put into keeping your plants running as  
16 they should.

17 A. Yes.

18 Q. Do you recall that testimony?

19 A. Yes.

20 Q. So that then would certainly be in  
21 disagreement with the second part of this statement?

22 THE CHAIRMAN: Well, no. I don't think  
23 so because they are really only talking about  
24 construction and manufacture of nuclear equipment.

25 MR. MONDROW: Q. Mr. Penn, is it your

1 testimony or will you testify now that in the immediate  
2 future in Ontario there will be a lot of energy in the  
3 context of the existing system put into the  
4 manufacturing of nuclear equipment?

5 MR. PENN: A. I'm not sure that I  
6 understand your question.

7 I can understand the last sentence. What  
8 it infers is that significant funding through the  
9 Intervenor Funding Act could cause long and protracted  
10 hearings which may use some - perhaps they are talking  
11 about me here - some of the skilled employee  
12 infrastructure in construction and manufacture of  
13 nuclear equipment.

14 Certainly while I am here I am not  
15 designing nuclear plant. That is all I can say.

16 Q. Let me just clarify your previous  
17 testimony, then, as I understood it.

18 I thought that you testified that there  
19 is no immediate danger in the immediate future that the  
20 nuclear industry infrastructure in Ontario will  
21 suffer - due to the moratorium, for example - and the  
22 reason you gave was that you are continuing to work on  
23 your existing plants.

24 So in terms of the construction and  
25 manufacture of nuclear equipment, do I understand you

1       then, or do I understand that statement to mean, that  
2       we should not be considered right now with the  
3       dismantlement of that infrastructure; it is not a  
4       current problem that Ontario Hydro is concerned with?

5               A. Well, I can't remember the exact  
6       context of my previous cross-examination. I think that  
7       it was in the context that given that the in-service  
8       date of a potential future nuclear plant is around 2010  
9       was there concern that the infrastructure for CANDU  
10      nuclear systems could be damaged?

11             And my answer was, no, I don't think so,  
12      because there will be significant efforts required to  
13      maintain our large current nuclear system; secondly,  
14      that there were significant investments occurring in  
15      Canada and elsewhere in the world to maintain the  
16      option available.

17             Now, what this CNA paragraph seems to be  
18      saying to me by inference, that if we had a continuous  
19      stream of long and protracted hearings where we never  
20      made a decision then industry obviously wouldn't have a  
21      business and would look elsewhere for business. That  
22      is all it says to me.

23             Q. Okay. Thank you. Page 13, please,  
24      fourth paragraph in the second sentence. The sentence  
25      says that the industry's activities -- and I believe it

1 is referring to the uranium mining industry as  
2 indicated earlier on the page:

3 The industry's activities have been  
4 and are expected to continue to be  
5 subject to scrutiny by the government  
6 agencies responsible for protection of  
7 the environment.

8 Do you agree with that statement, Mr. Penn?

9 A. I agree that it is very appropriate  
10 for government regulators to scrutinize the activity of  
11 others.

12 Q. On page 14 of the brief there is a  
13 discussion, and I will editorialize and say with some  
14 trepidation, and you can correct me if you don't read  
15 it this way, of the --

16 A. Which part of the page are we looking  
17 at?

18 Q. I am not quoting directly yet. I  
19 will indicate for you in a second. I think that on the  
20 page -- in my reading there is a discussion of the  
21 Atomic Energy Control Board Cost Recovery Guidelines  
22 proposal, and you will see in the last paragraph there  
23 is a discussion of a 22 per cent increase in fees  
24 charged to the nuclear industry, and you will see in  
25 the sentence that begins "However":



1                   ...the assessment fee for a siting or  
2                   for a uranium mine construction license  
3                   is proposed to change from \$84,600  
4                   annually to a charge of \$1,608,000. This  
5                   is an increase of over 800 per cent,  
6                   assuming it takes two years for the  
7                   assessment process.

8                   Mr. Penn, that kind of price or fee  
9                   increase would impact on Ontario Hydro's nuclear  
10                  fueling cost and security; is that fair?

11                  A. Well, I assume that a share of this  
12                  increased license fee - and I can't vouch for the  
13                  accuracy of those particular numbers - would be passed  
14                  on to Ontario Hydro and its future contracted purchases  
15                  of fuel.

16                  Q. And on the next page then, please,  
17                  Mr. Penn, page 15, second last paragraph -- excuse me  
18                  for just a second.

19                  I am looking at the second last  
20                  paragraph, and the first sentence says, "Such a  
21                  delay...", and I am just trying to find for you the  
22                  reference earlier in the page that speaks of what delay  
23                  is referenced there, if you just bear with me for a  
24                  minute.

25                  Mr. Marcus points out that -- I am trying



1 to take you right to the quotes to make it easier. It  
2 is in the previous paragraph, the first sentence:  
3 Significant delays in approvals have also been  
4 introduced. And again, this is still in the context of  
5 the uranium mining industry.

6 Then the paragraph, the second last  
7 paragraph that I wanted to take to you, says: Such a  
8 delay has three major impacts on the industry. And the  
9 first is a financial impact, which is associated with  
10 the preparation of environmental impact statements.  
11 Perhaps I will read:

12 ...a financial impact; preparation of  
13 an environmental impact statement is a  
14 costly undertaking and interest payments  
15 on this money during unanticipated delays  
16 are a significant burden.

17 Mr. Penn, is it Ontario Hydro's knowledge or your  
18 knowledge that this is a concern in the uranium mining  
19 industry?

20 A. Well, I'm sorry, I don't know if any  
21 of my colleagues could help me, but I'm not familiar  
22 with any particular delays in licensing mines in  
23 Saskatchewan, so I don't know which companies are  
24 involved, and I don't know, relative to their size,  
25 what financial impact such a delay in a hearing might

1       cause.

2                   Q.   If there were such delays, gentlemen,  
3       would that adversely affect Ontario Hydro?

4                   A.   Well, it clearly would if Ontario  
5       Hydro had contracted from this particular company in  
6       Saskatchewan or wherever to receive uranium from a mine  
7       that had not yet received approval to even develop  
8       itself.   So, I can't imagine that Ontario Hydro would  
9       find itself in that circumstance.   So I guess the  
10      answer is no.

11                  Q.   Okay.   Thank you.

12                  A.   But just a personal, logical  
13      deduction.   Nothing more.

14                  Q.   On page 16, please, the last  
15      reference, do you see a heading that reads Impact of  
16      the Implementation of Proposed New Radiation Exposure  
17      Limits, and the paragraph right under that heading  
18      starts:

19                         The Atomic Energy Control Board has  
20                         published proposed new exposure limits,  
21      and it is consultative document C-122,

22                                 which could have serious economic  
23                                 consequences for various companies and  
24                                 institutions involved in nuclear  
25                                 technology.

1 If you skip down to the last sentence, please, of the  
2 paragraph, it says:

3 Indeed, the proposed new regulations  
4 may well render underground uranium  
5 mining unviable.

6 Do you have any knowledge of that circumstance or that  
7 concern, Mr. Penn?

8 A. No, I'm afraid I don't. I don't know  
9 if Mr. Johansen does, or Dr. Whillans.

10 MR. JOHANSEN: A. I think part of the  
11 answer, or part of our answer, lies in the word  
12 "uranium export market", which is in the same  
13 paragraph. As we have indicated before, Ontario  
14 Hydro's uranium requirements only amount to a fraction  
15 of the total uranium mining activity in the country  
16 and --

17 Q. I'm sorry, could you tell me where  
18 you see the words uranium export market? That would be  
19 in the next paragraph down that starts with the word  
20 Canada; is that right?

21 A. Yes. Oh, okay. I guess I was  
22 looking at the wrong paragraph, but that is what my eye  
23 caught.

24 Q. Right.

25 A. And it seems to me those are

1 important words to be read together with the first  
2 paragraph.

3 Q. But the concern is that proposed new  
4 regulations may well render underground uranium mining  
5 unviable whether the uranium goes out of the country or  
6 goes to Ontario Hydro. Is that your reading of the  
7 paragraph that I cited originally, Mr. Johansen?

8 A. Well, I understood that was your  
9 point.

10 Q. Yes.

11 A. But, I mean, my reading of those two  
12 paragraphs together suggests to me - I don't know the  
13 particulars of this, but it suggests to me - that the  
14 assessment of viability depends, to some extent at  
15 least, on the cost of uranium in the export market.

16 THE CHAIRMAN: The last paragraph  
17 would --

18 MR. JOHANSEN: That would seem to be --  
19 I'm sorry, Mr. Chairman?

20 THE CHAIRMAN: Go ahead. I interrupted  
21 you.

22 MR. JOHANSEN: And they call for some  
23 sort of international protocol. Again, I'm not a fuels  
24 expert, but it makes sense to me that if they are  
25 concerned about the export market what all of this is

1 saying is that, okay, we agree to follow these rules,  
2 but we want everybody else to play by the same rules.

3 THE CHAIRMAN: I was going to say the  
4 last paragraph should probably start with the word  
5 "if". It would scan better if it did.

6 MR. MONDROW: Q. Dr. Whillans?

7 DR. WHILLANS: A. Perhaps I could  
8 comment.

9 Of course, I just have general knowledge  
10 about what the situation in the mining industry is, but  
11 it is not my understanding that changing the  
12 regulations would necessarily make the underground  
13 uranium mining unviable.

14 I would point out, though, the situation  
15 isn't quite as simple in a mining operation as it is in  
16 Ontario Hydro. In my evidence I described how we have  
17 plans to actually go beyond the recommendations in  
18 C-122.

19 In a mine, as you know, miners are at  
20 much greater risk from non-radiological hazards, and if  
21 changes such as this meant that the other risks  
22 increased relative to what is not the major contributor  
23 to their risk, then it wouldn't necessarily be a good  
24 thing.

25 I think those are some of the concerns

1 that the mining companies have.

2 MR. MONDROW: Perhaps we can break for  
3 lunch, Mr. Chairman.

4 THE CHAIRMAN: Yes, we will adjourn until  
5 2:30.

6 THE REGISTRAR: This hearing is adjourned  
7 until 2:30.

8 ---Luncheon recess at 1:09 p.m.

9 ---On resuming at 2:33 p.m.

10 THE REGISTRAR: Come to order. This  
11 hearing is again in session. Be seated, please.

12 THE CHAIRMAN: Mr. Campbell.

13 MR. B. CAMPBELL: Mr. Chairman, I spoke  
14 to my friend, Mr. Mondrow. I understand Mr. Penn has  
15 one answer he wants to correct from this morning.

16 MR. PENN: Thank you. Mr. Chairman, I  
17 checked over lunch the status of Hydro's membership in  
18 CNA. And I was told that at this point in time, Hydro  
19 is a member.

20 THE CHAIRMAN: Do they have a member on  
21 the board of directors?

22 MR. PENN: I understand that Mr. Arvo  
23 Niitenberg is in that position but he has been unable  
24 to attend many meetings.

25 THE CHAIRMAN: Do you know anything else



1 about the participation of Hydro? For instance, are  
2 there other committees and things like that.

3 MR. PENN: I understand that at this time  
4 our membership is just being confined to being a  
5 member.

6 THE CHAIRMAN: And having a membership on  
7 the board.

8 MR. PENN: I understand we are not  
9 participating in information meetings.

10 THE CHAIRMAN: Okay.

11 MR. MONDROW: Thank you, Mr. Penn.

12 Mr. Chairman, first a little bit of  
13 business, please. I would like to file two more new  
14 exhibits which I have provided copies of to Mr.  
15 Campbell. We won't be referring to them until  
16 Thursday, but I would like to put them on the record  
17 now, please.

18 The first is entitled: Update and  
19 Revision to 9.7.111. I understand Mr. Lucas has told  
20 me the next exhibit number is 649.

21 THE REGISTRAR: 649?

22 MR. MONDROW: Yes.

23 THE REGISTRAR: Yes.

24 .---EXHIBIT NO. 649: Update and Revision to 9.7.111.

25 MR. MONDROW: And then the next number

1       650 will be given to the document entitled: The Cost  
2       of Nuclear Plant Capital Modifications, A Statistical  
3       Analysis. And there are copies here for those who  
4       would like it.

5       ---EXHIBIT NO. 650: The Cost of Nuclear Plant Capital  
6       Modifications, A Statistical Analysis.

7                   MR. MONDROW: There's one more matter I  
8       would like to clear up, Mr. Chairman.

9                   MR. B. CAMPBELL: Sir, do we have an  
10      exhibit number for the second one?

11                  THE CHAIRMAN: 650.

12                  MR. MONDROW: In light of our  
13      conversation earlier, before lunch, it's my  
14      understanding that when Ontario Hydro's witnesses are  
15      speaking, subject to an express qualification before  
16      they speak, their answers are answers from Ontario  
17      Hydro and not just personal opinion, subject, of  
18      course, to express qualification.

19                  In light of some of Mr. Campbell's  
20      comments, I just wanted to request a clarification of  
21      that. That would certainly affect some of the record  
22      that we tried to establish before the lunch break.

23                  MR. B. CAMPBELL: Mr. Chairman, these  
24      witnesses do appear on behalf of Ontario Hydro. They  
25      are qualified to give their opinion like every other

1 witness. My friend's series of questions about whether  
2 this was Hydro's policy or the corporate Hydro, would  
3 support a particular policy position argued by someone  
4 else.

5 I think the witnesses can only speak to  
6 the best of their personal knowledge. And those  
7 matters in the way that they are stated in documents  
8 like the CNA document may or may not have been  
9 considered at a senior level of Ontario Hydro. And the  
10 witnesses can only answer on the basis of their  
11 knowledge of that. They cannot, in my submission, be  
12 expected to say, unless the matter has been considered  
13 and they know the results, that this is a policy  
14 position that would be supported by Ontario Hydro if  
15 it's never been considered by it. They can speak the  
16 matters that they can speak to and not more.

17 MR. MONDROW: And I would like  
18 clarification, Mr. Chairman, that is again subject to a  
19 specific caveat preceding an answer. Any statements  
20 that the witnesses make are statements made on behalf  
21 of Ontario Hydro and not just personal opinion.

22 THE CHAIRMAN: Now, just a moment, Mr.  
23 Mondrow. It's very difficult to be categorical about  
24 these things. For instance, one witness might say, I  
25 would like to see such and such happen. Now, I don't

1 think that that necessarily means that you can walk out  
2 of the room and say that's Ontario Hydro's policy. I  
3 think that just wouldn't follow, in my view.

4 You cannot make generalizations about  
5 these things. They have to be in the context of the  
6 evidence that is being given and I think that is the  
7 only way you can handle it.

8 MR. MONDROW: Okay. Thank you, Mr.  
9 Chairman.

10 Q. Mr. Johansen, Hydro has been  
11 questioned a number of times in this hearing, and in  
12 this panel specifically --

13 THE CHAIRMAN: I want to just finish one  
14 thing. But I think when it does come to an issue which  
15 really where the policy issue is crucial, then I think  
16 you are entitled to know what Hydro's policy is. But I  
17 don't think that the other side of the coin necessary  
18 falls just because a witness happens to express a view  
19 that you can necessarily infer that that's some kind of  
20 policy that they have considered and come to a  
21 conclusion on.

22 MR. MONDROW: I think, Mr. Chairman, you  
23 have captured my concern, that these people, these  
24 gentlemen and others on other panels are here to speak  
25 on behalf of Ontario Hydro and that we should be able

1 to get Ontario Hydro's position. And I agree that  
2 generalizations are very difficult and they can be  
3 handled on a specific basis. But that's my  
4 understanding. Thank you.

5 Q. Mr. Johansen, I was about to ask you  
6 about the 1 per cent of DEL's issue which has been  
7 canvassed a number of times. And I'm afraid I'm a bit  
8 confused with some of the statements in the evidence,  
9 both that you have made and that have come before you.

10 I'm just going to ask you squarely. Is  
11 the 1 per cent limit that you have set as an Ontario  
12 Hydro operating criteria, is that also a condition of  
13 your operating licences?

14 MR. JOHANSEN: A. Well, I tried to be as  
15 straight forward and clear as I knew how to be in my  
16 direct evidence. And perhaps if I go back and try it  
17 again.

18 The derived emission limit is the  
19 regulatory limit which is specified in each nuclear  
20 operating licence. For example, in the Bruce "B"  
21 operating licence, which for some reason comes to my  
22 mind first, it is specified under condition A.A.7, and  
23 I believe that's more or less common for other  
24 operating licences. That is the reference to the  
25 regulatory limit, the DEL, which Ontario Hydro



1 estimates and the control board approves.

2 There is also, typically in these  
3 operating licences, reference to Ontario Hydro's  
4 -operating policy and procedures. And part of those  
5 policies and procedures is an undertaking, a  
6 commitment, I guess is a better way of putting it, to  
7 conduct a review into the need for changes, either in a  
8 physical sense or a procedural sense if Ontario Hydro  
9 exceeds on a consistent basis or to a significant  
10 extent beyond the 1 per cent of DEL operating target.  
11 So to answer your question, is that operating target a  
12 requirement?

13 Q. My question was, is that operating  
14 target a condition of the licence?

15 A. It's certainly referred to in the  
16 licence. And not being a lawyer, I couldn't say with a  
17 100 per cent certainty exactly what status that accords  
18 it. But two facts, I think, are clear: The DEL, in  
19 AECB's own words and we find references to this in a  
20 number of documents issued by AECB themselves, the DEL  
21 is the regulatory limit. The 1 per cent target is  
22 generally characterized by ourselves and the AECB as a  
23 target.

24 But clearly there is an onus on us which  
25 we have imposed on ourselves and which has been



1 endorsed by the control board. There is an onus on us  
2 to do something about a situation if that operating .  
3 target is routinely exceeded. I am not sure I can  
4 clarify it much further.

5 Q. If you exceed the 1 per cent, you  
6 have to report it, is that correct?

7 A. Oh, we have to report our performance  
8 regardless of whether we exceed it. There's no  
9 question if we exceed it that certainly would be  
10 reported.

11 Q. Is that a reportable -- and I might  
12 be confusing the terminology. There is a term that the  
13 AECB uses, it's a reportable incident or a reportable  
14 occurrence. An exceedance of 1 per cent would  
15 constitute a reportable incident, is that correct?

16 A. I probably should defer to my  
17 colleague, Mr. King, because he is more conversant with  
18 the normal procedures of reporting significant events.  
19 So perhaps I'll pass to him on that.

20 MR. KING: A. The releases are reported  
21 in the annual, the quarterly reports for the station.  
22 These reports are submitted to the control board.

23 [2:45 p.m.]

24 I think you are perhaps alluding to the  
25 significant event report system. I'm not sure.

1 But the significant event reports are  
2 dealing with an incident, not the release over a year  
3 period. But the AECB are getting reports on it via the  
4 quarterly reports of the station, and they are getting  
5 those whether they exceed the 1 per cent target or not.

6 Q. Mr. Johansen, when you say that it  
7 was a self-imposed target, what does that mean?

8 MR. JOHANSEN: A. That particular  
9 statement wasn't in reference to the target, although  
10 that's another matter perhaps that you want to pursue.

11 What I meant was that the commitment to  
12 undertake a review of the need for change, if we were  
13 to exceed that 1 per cent operating target on an  
14 ongoing basis, that is the commitment I referred to.  
15 That was a matter of Ontario Hydro operating a policy,  
16 which is, as you pointed out, referred to in the  
17 operating licence.

18 No doubt, I believe we have discussed  
19 this in previous testimony, there was consultation with  
20 the AECB staff on that at the time. But it's my  
21 understanding that that was Ontario Hydro initiative  
22 and it remains Ontario Hydro policy.

23 THE CHAIRMAN: Would the fact that you  
24 had, in any given report, period exceeded the 1 per  
25 cent amount, would that be a subject matter of comment

1 in any report to the regulatory agency?

2 MR. JOHANSEN: Mr. Chairman, I am not  
3 quite sure what the meaning of your question is.

4 THE CHAIRMAN: Well, Mr. King, your  
5 evidence has been that all releases are reported  
6 whether they exceed or whether they are below or above  
7 1 per cent, they are all reported anyway. But if there  
8 wasn't a release that was in excess of the 1 per cent  
9 amount, would that be a subject matter of a comment -  
10 given it's referred to in your licence - would that be  
11 the subject matter of a comment that you would make in  
12 your reporting to the agency?

13 MR. KING: The 1 per cent target is on an  
14 annual basis. There are quarterly reports every  
15 quarter.

16 I guess you could get into a situation  
17 where there are many little incidents which wouldn't be  
18 reported under the significant event reporting system  
19 which over a year period might exceed the 1 per cent  
20 target and given that you did do that, I have no doubt  
21 in my mind that that would be a matter of specific  
22 comment in the fourth quarter report for that year.

23 MR. MONDROW: Q. Mr. Johansen, I just  
24 want to clarify this, please. I am still a bit  
25 confused. Can you turn up Exhibit 570.

1 MR. JOHANSEN: A. Yes, I have that.

2 THE CHAIRMAN: What is 570?

3 MR. MONDROW: 570 is entitled: Four  
4 Items Concerning the Regulation of Radioactive  
5 Emissions from Ontario Hydro Nuclear Facilities. It  
6 was prefiled, Mr. Chairman, by IPPSO, close to the  
7 commencement of Panel 9, I believe.

8 If you could turn to the first document,  
9 for me, please. The title is the Licencing Process for  
10 Nuclear Power Reactors, Revision One. You can see that  
11 it is Atomic Energy Control Board document, you can  
12 also see it is dated the November 1979. I am informed  
13 by AECB staff that it is the most current version of  
14 this document.

15 If you turn to page 25 of the exhibit,  
16 please.

17 Incidentally, the document describes the  
18 licencing process, as the title indicates, for nuclear  
19 power reactors and was applied to Darlington as the  
20 most recent reactor, and similarly applied to the  
21 preceding reactors, I am advised by the AECB.

22 At page 25, which is page 20 of the  
23 document itself, there is a heading 4.5, Operating  
24 Policies and Principles. Starting at the first  
25 sentence under this heading:

1                   This document is prepared by the  
2                   applicant and outlines overall  
3                   constraints that govern the operation the  
4                   of the facility. As such, it not only  
5                   provides guidance for the preparation of  
6                   operating procedures, but it also  
7                   constitutes a commitment by the applicant  
8                   that will become a condition of his  
9                   operating licence.

10                  Now, Mr. Johansen, the 1 per cent target  
11                  is referred to in that document, operating policies and  
12                  principles. Would you agree with me that in fact that  
13                  target is a condition of the operating licences for the  
14                  reactors?

15                  MR. B. CAMPBELL: If we are going to get  
16                  this specific, could we please get out the portion of  
17                  the operating document that's being referred to.

18                  MR. MONDROW: That would be Exhibit 159,  
19                  Mr. Chairman.

20                  Q. Mr. Johansen, I will take you to the  
21                  references that your counsel has requested.

22                  MR. JOHANSEN: A. Yes, I have both  
23                  documents.

24                  MR. B. CAMPBELL: Could I get this  
25                  exhibit?

1 MR. MONDROW: Mr. Chairman, I provided  
2 Mr. McDonald of Ontario Hydro with several copies of  
3 that this morning. There was some concern that they  
4 did not have the full version. It's got a precis on  
5 the front and it's entitled: Excerpts from Operating  
6 Licence for Bruce Nuclear Station.

7 MR. B. CAMPBELL: I have here it.

8 MR. MONDROW: Q. Second page of that  
9 document, please.

10 First of all, I guess we should go to the  
11 first page. Mr. Johansen, this is the power reactor  
12 operating licence for Bruce nuclear generating station  
13 "B"? The first page indicates that in the title?

14 MR. JOHANSEN: A. Yes.

15 Q. Second page, please, top paragraph:

16 The operation of a nuclear facility is  
17 subject to the conditions specified in  
18 attachments AA and AB to this licence  
19 with which Ontario Hydro shall comply.  
20 You testified to that a few minutes ago.

21 A. Yes.

22 Q. Turn the page, please, we see  
23 attachment AA and in A.A.1, as I believe you have  
24 testified as well, it says:

25 Operation of a nuclear facility shall



1 be governed by and be in accordance with  
2 the document entitled operating policies  
3 and principles.  
4 It gives the date and prepared by Ontario  
5 Hydro.

6 A. Yes.

7 Q. And if you continue, please, looking  
8 to the last page of the exhibit, which is page 6 from  
9 Bruce nuclear generating station "B", operating  
10 policies and principles. Can you confirm that, please?

11 MR. B. CAMPBELL: Just a minute. Sorry.

12 MR. MONDROW: Q. Mr. Johansen, can you  
13 confirm that, please?

14 MR. JOHANSEN: A. That is what this  
15 particular excerpt says. I could check it, subject to  
16 check I suppose I should say. It looks similar to  
17 requirements which I have seen.

18 Q. I will ask you then to accept subject  
19 to check, and you can advise us, please, if it is  
20 otherwise.

21 A. This a part of the overall operating  
22 policies and principles.

23 Q. Which forms a condition of the  
24 licence as we have just seen; correct?

25 A. Yes, as a whole.

1 Q. As a whole. And one of the elements  
2 in this document, operating policies and principles,  
3 says, it's the third paragraph on the page:

4 If emissions regularly or  
5 significantly exceed 1 per cent of the  
6 derived emission limits, the need for and  
7 the practicality of modifications to  
8 equipment and or procedures shall be  
9 reviewed.

10 Mr. Johansen, that is a condition of your  
11 operating licence, is it not?

12 A. It is now.

13 Q. It is now?

14 A. Yes.

15 Q. Has it not always been a condition of  
16 your operating licence from Bruce "B" or any of the  
17 other facilities?

18 A. I couldn't say for certain whether it  
19 has always been, but it clearly is part of it now.

20 I don't believe that anything in this  
21 paragraph contradicts what I have said.

22 Q. No, and I take your point.

23 A. I would like, for sake of  
24 completeness, to refer back to page -- well, I am not  
25 sure the page is on here, but it's paragraph A.A.7,

1 which is the other part that I have referred to in my  
2 initial response to you, and this is the reference to  
3 the derived emission limits document, which has to be  
4 considered together with the operating policies and  
5 principles.

6 Q. So both of those documents, the DEL  
7 document and the operating policies and principles form  
8 in their entirety and including that's written in there  
9 conditions of the operation of the facilities; is that  
10 fair? Is that right?

11 A. Yes, that's correct. And just to  
12 round out my view, my interpretation of all of this,  
13 Dr. Whillans brought to my attention a document which  
14 was presented earlier by one of the parties, this is an  
15 annual report from the Atomic Energy Control Board on  
16 radioactive release data from Canadian nuclear  
17 generating stations issued in January of 1990.

18 I said annual, I am not sure that it in  
19 fact is annual, but it's a report which they update  
20 periodically at least. In that document on page 2 they  
21 say:

22 At present, nuclear generating  
23 stations maintain an operating target  
24 such that emissions not exceed 1 per cent  
25 of each DEL.

1                   As the following data indicate, for  
2                   the most part...

3                   They are talking about all CANDU reactors  
4                   across the country.

5                   ...for the most part this operating  
6                   target is achieved. Although DELs are  
7                   expressed on an annual basis, the rate of  
8                   emission is controlled by...

9                   And they go on.

10                  I guess my point is that in the words of  
11                  the AECS themselves, there is a distinction between the  
12                  DEL, the regulatory limit, versus the operating target  
13                  and that's all I have sought to clarify, is that  
14                  distinction.

15                  Q. Okay.

16                  A. As to whether the 1 per cent target  
17                  is a condition of the operating licence, that is a  
18                  matter of documentation. I don't seek to dispute that.

19                  Q. Okay. Thank you.

20                  MR. B. CAMPBELL: Mr. Chairman, in case  
21                  my friend is in any doubt, it is Ontario Hydro's legal  
22                  position that the legal regulatory limit is the DEL.

23                  THE CHAIRMAN: There is no such condition  
24                  in the licence that it restricts it to 1 per cent.

25                  MR. B. CAMPBELL: That is correct. What

1 is referred to in the operating document in our view is  
2 a legal reporting requirement, that legal regulatory  
3 emission limit is condition A.A.7.

4 THE CHAIRMAN: If it happens a lot,  
5 regularly, or if it's significant, they have got to  
6 review the situation. That's all it says.

7 MR. B. CAMPBELL: That's all it says.

8 MR. MONDROW: Mr. Chairman, I would just  
9 ask Mr. Campbell before he is seated to clarify for my  
10 benefit, is it Ontario Hydro's position that the 1 per  
11 cent is not a condition of the licence?

12 THE CHAIRMAN: That's what he said, Mr.  
13 Mondrow.

14 MR. MONDROW: I thought so too. Is that  
15 what he said, Mr. Chairman?

16 MR. B. CAMPBELL: What we have said is  
17 that the condition of the licence is that we will  
18 review and report when the 1 per cent is exceeded. And  
19 I am paraphrasing the words from the operating  
20 document, the actual licence condition on emissions is  
21 A.A.7.

22 MR. MONDROW: Thank you, Mr. Chairman.

23 Q. Mr. Daly, could I ask you to turn up  
24 transcript Volume 16, to page 2866.

25 MR. B. CAMPBELL: I don't think we have

1 it in the room.

2 THE CHAIRMAN: 16?

3 MR. MONDROW: 16, Mr. Chairman. I had  
4 advised Ms. Harvie from Ontario Hydro that I would be  
5 referring to it.

6 MR. B. CAMPBELL: This was in a letter we  
7 got yesterday and we have been struggling to get  
8 everything together.

9 THE CHAIRMAN: What page?

10 MR. MONDROW: 2866.

11 Q. Mr. Johansen, perhaps I will read to  
12 you the excerpt I am concerned with, and if you like to  
13 wait until the transcript comes and come back to it,  
14 that is fine, but we will just see if we can go ahead  
15 until we get into a situation where you would like to  
16 stop.

17 [2:58 p.m.]

18 For the record, at line 24 of that  
19 transcript, and this is a statement made by Mr. Taborek  
20 in Panel 2, he says:

21 We do not know what environmental  
22 rules we will have to meet in future. We  
23 have basically been hit with a new set of  
24 environmental rules roughly every two  
25 years during the 1980s. We expect more.



1                   Mr. Daly, are those comments pertinent to  
2 nuclear generation? And I pause because I am not sure  
3 that I am asking the right person, but if someone else  
4 would like to answer, that's fine.

5                   Mr. Johansen?

6                   MR. JOHANSEN: A. The question is about  
7 environmental regulations or rules, in the words of Mr.  
8 Taborek?

9                   Q. In the words of Mr. Taborek, he says  
10 he doesn't know what environmental rules will have to  
11 be met in the future, that Hydro has basically been hit  
12 with a new set of environmental rules every two years  
13 during the 1980s.

14                  A. Well, I'm sure he had done some  
15 research on the frequency of regulatory changes before  
16 making that remark, and I'm afraid I haven't recently.

17                  Knowing the position of Mr. Taborek, I  
18 believe he would have been thinking primarily about  
19 changes in the regulation of fossil fuel generation or  
20 regulations in the acid gas control area, for example,  
21 and I suppose he might also have been thinking about  
22 pending regulation in the abatement of liquid effluents  
23 under the MISA program.

24                  Q. My references are a bit confused, but  
25 that is why I was just checking back to the transcript.

1                   Mr. Penn, I believe that you testified  
2           that there has been a progression of regulatory  
3           requirements by the safety regulator and that you  
4           expect that trend to continue; is that right - in the  
5           context of nuclear?

6                   MR. PENN: A. I think I was referring to  
7           the construction of Darlington when I made that and  
8           also to the fact that there is provision in the capital  
9           cost estimate for any future plant for the same level  
10          of expenditure on licencing issues as was the case with  
11          Darlington.

12                  Q. Yes, I recall that. I'm not sure who  
13          to direct this question to. Emissions from Darlington  
14          are lower than emissions from Pickering; is that right?

15                  A. I think these, by the way, were  
16          not -- these are regulatory, interpretations of  
17          regulatory requirements not related to the environment  
18          or emissions, but related to safety-related equipment  
19          and seismic effects and the like.

20                  Q. Your comments that I referred to?

21                  A. Yes.

22                  Q. But generally, are emissions from  
23          Darlington less than emissions from Pickering in the  
24          normal course of operations?. I believe your overheads  
25          had some charts to that effect; is that right?

1 MR. JOHANSEN: A. Well, I presented a  
2 series of charts in Exhibit 519--

3 Q. Yes.

4 A. --including the emissions from  
5 Darlington for the year 1990, and that is a partial  
6 record only. The plant began operating in 1990 and  
7 only the one unit, so it's -- and that evidence  
8 included emissions over a five-year period for the  
9 other existing plants.

10 So it would be difficult to assess  
11 whether to this point Darlington, in a normal four-unit  
12 operating configuration, would be emitting less than  
13 Pickering. So I am not quite sure what the context of  
14 Mr. Taborek's statement was.

15 Q. Okay. Perhaps we can then refer to  
16 the nuclear context specifically. That might assist  
17 us.

18 If you can turn up in our interrogatory  
19 package the first page, Interrogatory 9.2.25, which,  
20 Mr. Lucas, I believe should be given a number.

21 THE REGISTRAR: That will be 520.125.

22 ---EXHIBIT NO. 520.125: Interrogatory No. 9.2.25.

23 MR. MONDROW: Q. Energy Probe asks for  
24 the best estimate as to the effect in terms of cost and  
25 output for each nuclear unit, life-shortening system

1 reliability and any other affected aspects of Hydro's  
2 operation if all Pickering "A" units had to achieve  
3 Darlington safety standards to be allowed to operate.

4 And the response was that Hydro hadn't  
5 done that analysis. Is that answer still correct?

6 MR. KING: A. To my knowledge, it is  
7 still correct.

8 Q. Thank you. I assume the same is true  
9 for Bruce, no cost analysis for either of the Bruce  
10 stations has been done to see what it would cost and  
11 what the effects would be of upgrading to Darlington  
12 regulatory standards?

13 A. Yes. This is not something which we  
14 are asked to do, and it is not something that we would,  
15 you know, do by ourselves. So there are no studies, to  
16 my knowledge, for any plant, studies of that nature.

17 Q. The plants could be upgraded, could  
18 they not, to meet Darlington standards? There is  
19 nothing physically impossible about doing that?

20 A. Well, I'm not sure about that. I  
21 think you would have to go through on a regulation-  
22 by-regulation basis to draw that conclusion, and that  
23 hasn't been done.

24 Q. There are many backfits that you are  
25 required to do by the Atomic Energy Control Board which

1 you in fact do on your older plants. You testified to  
2 that, I believe. So there are some things that --

3 A. But your question was--

4 Q. Yes.

5 A. --whether everything was practical or  
6 whether it was physically possible to do it.

7 Q. Yes, and you answered that question  
8 and now I am asking another question, and that is: You  
9 have in the past been required to go back to your old  
10 stations and backfit in order to achieve a higher level  
11 of regulatory satisfaction, if I can put it that way.  
12 That's correct?

13 A. Yes, there are instances like that.

14 Q. I guess I was a bit surprised because  
15 given the concern for ALARA that you and other Hydro  
16 witnesses have spoken to I would have imagined that an  
17 analysis of what was possible and economic and helpful  
18 would have been done with each of the stations to  
19 determine what more you could do apart from specific  
20 requests from the board to upgrade the operation of  
21 your old stations.

22 A. Would you like my comments on that?

23 Q. Yes, please.

24 A. The way you have asked the question  
25 here is referring to safety standards and now you are



1 talking about ALARA. These are two different things.

2 When we understand the word "safety  
3 standards", it is primarily rules and regulations  
4 referring to accident conditions in the plant,  
5 potential accident conditions.

6 Design rules, ALARA, is something which  
7 is applied to the more frequent, the normal releases,  
8 not the very low probability accident situations.

9 Q. Has there been an ALARA analysis for  
10 the old stations? Is it updated regularly?

11 A. I am going to have to pass you over  
12 to somebody else on that one.

13 Q. Mr. Johansen, I think?

14 MR. JOHANSEN: A. Well, I can perhaps  
15 make a comment and others may add their own comments.

16 The ALARA process as applied in Ontario  
17 Hydro is one that is used for assessing the cost  
18 effectiveness or cost/benefit of improving or reducing  
19 emissions under normal operating conditions, not  
20 contingency or accidental conditions, and we don't  
21 always carry out a full or formal ALARA analysis in  
22 justifying improvements. That is one part of the  
23 answer.

24 However, the rehabilitation programs that  
25 I believe both Mr. Daly and Mr. Penn talked about,



1 which are under way or getting under way for the  
2 existing plants at Pickering and Bruce, do include  
3 consideration of environmental improvements as well.  
4 And I have mentioned some of the examples in the liquid  
5 waste management area and improvements in monitoring of  
6 both liquid and airborne emissions.

7 Whether in the final analysis for  
8 purposes of getting release of funds to actually  
9 implement these improvements when the decision has been  
10 made, whether that will require a formal ALARA analysis  
11 I can't say.

12 Q. When you have got older stations that  
13 aren't operating to the environmental or safety  
14 standards of the newer stations, you have got greater  
15 emissions from the older stations than the newer  
16 stations, and I understand you to be saying that you  
17 haven't done any comprehensive analysis of what it  
18 would cost to upgrade those older stations to current  
19 standards; is that your evidence?

20 A. Oh, I am not saying that we haven't  
21 done any analysis. There have been preliminary  
22 estimates done on some of the improvements that I have  
23 talked about.

24 What I was hedging was an indication that  
25 we have done a formal ALARA type analysis. I don't

1 believe that that has been done in the context of these  
2 rehab programs. However, it might indeed be done as  
3 part of the decision analysis that would have to go to  
4 our board of directors for release of funds to actually  
5 implement the various elements of the rehabilitation  
6 program in the end.

7 Q. Mr. Daly, these might be questions  
8 for you. I would like to talk about a reliability  
9 issue, common mode failure, and I would like to start,  
10 please, with Volume 22 of the transcript, if you have  
11 that, page 3844.

12 MR. DALY: A. I have that.

13 Q. Mr. Taborek there, again from Panel  
14 2, is talking with Mr. Shepherd, I believe, about  
15 common mode failures, and he defines it as:

16 A failure that affects more than one  
17 unit at a time, and by contrast other  
18 facilities that don't have common modes,  
19 each unit fails in a totally independent  
20 manner.

21 That definition in essence contemplates  
22 one cause taking down two or more units; is that right?

23 A. Correct, and basically at the same  
24 time or within a very short time period.

25 Q. If one cause took down units at a

1 different time could that not be considered a common  
2 mode failure in the sense that same cause is causing an  
3 outage, it is just that the outage is at a different  
4 time for each of the two or more units?

5 A. In a sense. However, you would have  
6 to look at the time period between the two events. In  
7 some cases the same cause could be, you know, a matter  
8 of seconds. In other cases it could be over a period  
9 of months. And obviously, the closer they are in time  
10 there is more concern from the sort of immediate impact  
11 on the system point of view.

12 So they tend to be treated in different  
13 categories.

14 Q. Perhaps just to keep the distinction  
15 clear then, for the following discussion we can refer  
16 to common cause failures that occur at different times  
17 as common problems for a given system; is that fair?

18 A. Fine.

19 Q. Just to distinguish the two concepts.  
20 As a general principle would it be fair to say where a  
21 system relies heavily on a particular design or a  
22 particular technology the risk of either common mode  
23 failure or common cause failures or common cause  
24 problems is greater?

25 A. Where the bulk electricity system

1 relies on --

2 Q. No, where a particular generation  
3 system or sub system relies heavily on a particular  
4 design.

5 I'm sorry, let me rephrase the question.  
6 I think you are correct. What I was trying to ask you  
7 was, where the electricity generation system relies on  
8 a particular design or a particular technology does the  
9 risk of common cause failures increase relative to a  
10 system that doesn't have that heavy reliance?

11 A. Well, if you have a system that is  
12 made up of 100 identical units as opposed to a system  
13 which has 100 non-identical units I would say that is  
14 generally true.

15 Q. And it is true for variations? If  
16 you have a system that relies 60 per cent on a  
17 particular type of technology as opposed to 40 per cent  
18 the risk to that system is greater if that technology  
19 develops a common problem?

20 A. Well, there are many other things you  
21 have to consider. There is the particular age of the  
22 units, the particular design of the units. Although  
23 you might say that, you know, we have 50 to 60 per cent  
24 of our system is CANDUs, these CANDUs are of different  
25 age, different design, different ways of operating, so

1 they are not the cookie cutter CANDUs that Mr.  
2 Heintzman was talking about.

3 Q. And in your hypothetical of the  
4 system that relies 100 per cent on a given technology  
5 obviously the consequences of a common mode problem  
6 increase the risk?

7 A. That's true, and that is why we have  
8 a balanced system. That is why this whole proposal  
9 that Hydro has put forward is a balanced proposal, it  
10 has what we think is an appropriate mix of large  
11 baseload systems, and NUGs, and all the rest.

12 Q. And again, as a general principle,  
13 would it be fair that a younger technology would be  
14 more likely to have common mode problems or common  
15 problems than an older technology, as a general  
16 statement?

17 [3:08 p.m.]

18 A. As a general statement, it would  
19 depend whether the younger technology had gone through  
20 a prototype phase, how different the technologies were,  
21 it's probably generally correct, but we would have to  
22 look at the particular designs in each case and make a  
23 judgment.

24 New and better designs come up from time  
25 to time that can out-perform older technologies. So



1 it's not a given in every situation.

2 Q. And it seems intuitive, just as a  
3 general proposition again, that the more complex the  
4 system or technology, the greater the risk of common mode  
5 problems or common problems. Would you agree with  
6 that.

7 A. I guess I would say generally, yes.  
8 But recognizing the greater complexity, what is  
9 normally done is to put in additional testing,  
10 additional inspection, additional design and defence  
11 indepth. So your operating techniques reflect the  
12 design you have got, and if you have got greater.  
13 complexity in design, you will tend to have procedures  
14 which match that; if you have less complexity, you will  
15 have less.

16 Q. Okay. If you turn up Exhibit 148C,  
17 please. This is the April 1991 forecast of reliability  
18 indices, and C, I think, because it's the third  
19 iteration since the hearing started.

20 If you could go to page 30, please, which  
21 is table 22A.

22 A. I have that.

23 THE CHAIRMAN: What is the page?

24 MR. MONDROW: Page No. 30, Mr. Chairman.  
25 It's table 22A, page numbered 30.



1 Q. We are given frequency and duration  
2 numbers on that table for common cause forced outages  
3 for nuclear stations, for two, four and eight unit  
4 simultaneous outages. We have a transcript undertaking  
5 from --

6 THE CHAIRMAN: I'm sorry, I'm in trouble  
7 here. I have got four documents all marked 148. April  
8 1991?

9 MR. MONDROW: That's right. It's  
10 entitled the 1990 Forecast actually, but it's dated  
11 April 1991.

12 THE CHAIRMAN: Page 30.

13 MR. MONDROW: Page 30. We are looking at  
14 table 22A which gives common mode outage.

15 THE CHAIRMAN: All right, I have got it  
16 now.

17 MR. MONDROW: Okay. Durations and  
18 frequencies, for a 1,000 years.

19 Q. We have asked some questions about  
20 this with some earlier witness and we got a transcript  
21 undertaking which I have included for convenience at  
22 page 6 of Exhibit 647. It has already got an exhibit  
23 number, it's 142.55. I will ask you to open that up,  
24 please.

25 MR. DALY: A. Yes, I have that.

1 Q. Thank you. And Ontario Hydro's staff  
2 have just calculated through the frequencies for us  
3 from this table in Exhibit 148C. At the bottom we see  
4 some numbers, 45 days out of 10,000 for Pickering "A"  
5 and "B" to be out simultaneously, 38 days out of 10,000  
6 and 36 days out of 10,000 Bruce "A" and "B" and for  
7 Darlington to be added to those outages respectively.

8 A. Sorry, you said 10,000. I think it's  
9 1,000.

10 Q. Right, I'm sorry. I was talking  
11 about 45 days out of 10,000 would be 4.5 out of 1,000.  
12 We can do it in 1,000s, that's fine.

13 So it's 4.5 days out of 1,000, 3.8 days  
14 out of 1,000 and 3.6 out of 10,000 respectively -- I'm  
15 sorry, 3.6 out of 1,000.

16 Those probabilities are pretty low in any  
17 event, would you agree, Mr. Daly?

18 A. Yes, I would agree. We did look at  
19 this at the time of preparation of this document. And  
20 we, together with our colleagues in design, looked at  
21 this from two different viewpoints and these were our  
22 best estimates at this time. This excludes some of the  
23 planned common mode events such as vacuum building  
24 outages that we would do in a planned manner. So  
25 that's a different category here. We are looking at

1 the forced outages.

2 Q. Does this analysis include any of the  
3 accident scenarios that you have done?

4 A. This analysis was largely based on  
5 our operating experience to date over the 200-odd  
6 reactor years we have had. And we have had a  
7 relatively small number of common mode-type events.

8 From a design perspective, they did look  
9 ahead. I think most of the accidents postulated would  
10 normally be expected to happen on one unit at a time.  
11 So any contribution from a common mode accident I would  
12 expect to be pretty small. I think the bulk of this  
13 reflects operating experience we have had, and this has  
14 been typical of our experience to date.

15 Q. And I understand that those numbers  
16 include only equipment failures, is that correct? It  
17 wouldn't include things like strikes, for example.

18 A. Well, it includes equipment failures,  
19 any incapability that has been caused. The  
20 incapability could be caused by human error, for  
21 example. So if there were an incident in our history  
22 where we had a couple of units shut down at the same  
23 time that was related to all or partially due to human  
24 error, that would show up in our operating experience.

25 Q. Okay. Back in Volume 22, please, you

1       should still have that out. Again with Mr. Taborek at  
2       page 3853, starting at line 9, in discussing these  
3       numbers the question is put to Mr. Taborek, "You, in  
4       fact, said the other day that you are, your words were  
5       not very satisfying."

6                       Mr. Taborek answers, "That is correct."  
7       The questioner goes on with these numbers. And Mr.  
8       Taborek continues on at line 14:

9                       I believe I explained...skipping a few  
10                      words...that when you look at our past  
11                      history we have experienced forced outage  
12                      rates higher than forecast, roughly 50  
13                      per cent at a time, and a good number of  
14                      those might be called common cause  
15                      failure. Whereas when you look at these  
16                      numbers, which are a subset of what might  
17                      be common cause failures, we get very low  
18                      numbers. And, therefore, we don't think  
19                      we have good statistics.

20                      A. I think, perhaps, what we are getting  
21       into here as I interpret Mr. Taborek's remarks as the  
22       comment you made earlier on about some of these common  
23       mode effects occur within a very short time-period.  
24       It's those that we were trying to capture in this table  
25       in 22A.

1                   And this was initially prepared at the  
2     request of system planning. And it was done more from  
3     a capacity point of view. We were interested in the  
4     frequency of two unit, four unit, or eight unit outages  
5     on the system in a very short time-period. So this was  
6     primarily, looking at this from a capacity viewpoint.  
7     I take Mr. Taborek's comments here in the first  
8     paragraph, "When you look at our past history, we have  
9     experienced forced outage rates higher than forecast,  
10    roughly 50 per cent at some times," I haven't read the  
11    full text here, but I would take that to be a comment  
12    on our more general forced outage experience.

13                   And certainly that's a correct comment.  
14    We have experienced forced outage rates significantly  
15    higher than forecast, no question. A good number of  
16    these might be called common cause failure. I could go  
17    along with that in the sense of some of them being  
18    common problems which were repeated on later units.  
19    But our review of the operating experience indicates  
20    that there is a fairly small number of those, as  
21    reflected in the table, that are within a very short  
22    time period, that are instantaneous types.

23    [3:25 p.m.]

24                   Q. Well, Mr. Taborek was talking about  
25    this table specifically. If you turn, please, to page



1 3857, starting at line 19, there was some discussion  
2 there about whether there was some sort of a study done  
3 or a specific data analysis, Mr. Taborek says at line  
4 23:

5 I think some rudimentary calculations  
6 would have been done, but I would not  
7 call it an analysis.

8 In order to clarify exactly what these  
9 numbers are supposed to account for, could I get an  
10 undertaking to provide that rudimentary analysis, or I  
11 guess first of all to inquire as to it and secondly to  
12 provide it if you can find it?

13 A. Yes. I think it would be fair to  
14 call it some rudimentary calculations. We did review,  
15 as I said, our operating experience over a period of a  
16 number of years. This particular classification of  
17 common mode incidents we only started doing it about  
18 two to three years ago. And after we had got into it  
19 for a while we realized that it was more of a  
20 capacity-related issue than energy-related issue, and  
21 the bulk of this document is related to energy-related  
22 issues.

23 So we will continue today it in the  
24 future but probably not on the same format. However,  
25 we did do that analysis, the analysis that we have done



1 could be made available.

2 MR. MONDROW: Could we get a number for  
3 that please, Mr. Chairman?

4 THE CHAIRMAN: Next undertaking number?

5 THE REGISTRAR: 532.12.

6 ---UNDERTAKING NO. 532.12: Ontario Hydro undertakes to  
7 provide the rudimentary calculations in  
8 reference to transcript page 3857, line  
9 23.

10 MR. MONDROW: Q. Mr. Daly, I noticed,  
11 and as a matter of fact you mentioned that you did that  
12 I think one year previously, that would be Exhibit  
13 148B, which was would be the previous year's analysis.  
14 If you could turn that up and going to table 18,  
15 please, which is on page 23.

16 THE CHAIRMAN: Just a minute now. What  
17 is the date of the interrogatory for 148B?

18 MR. MONDROW: The date of the report,  
19 sir, would be January 1990. It's the 1989 forecast of  
20 reliability indices.

21 THE CHAIRMAN: I have got it. What page?

22 MR. MONDROW: Page No. 23, table 18.

23 Q. I just turned to this table because  
24 the numbers on this table are lower than the numbers we  
25 saw in table 22A of 148C, so obviously there was some  
kind of an analysis done to adjust those numbers

1 upward. Could you give us anymore information on that  
2 adjustment, Mr. Daly? What was that based on?

3 MR. DALY: A. We have only been doing  
4 this particular analysis over a period of two to three  
5 years. Part of the method of doing the analysis was to  
6 seek input from staff around the different divisions,  
7 kind of get, if you like, expert input from the field  
8 and design, and the second year we did this we got  
9 different views, partly based on events that had  
10 happened over the year, but I think based on a sort of  
11 a more critical analysis and having more time to think  
12 about it.

13 It was a developing type of analysis. I  
14 would go along with Mr. Taborek's remarks, that  
15 initially they were fairly rudimentary and we are kind  
16 of improving as we go along.

17 Q. I take that Exhibit 148C though is  
18 the latest iteration of those particular numbers; is  
19 that right?

20 A. That's the latest published edition,  
21 yes, it is.

22 MR. MONDROW: Mr. Chairman, I will be  
23 moving on to a new section, perhaps we could take the  
24 afternoon break.

25 THE CHAIRMAN: All right, 15 minutes.

1 THE REGISTRAR: Please come to order.

2 This hearing will recess for 15 minutes.

3 ---Recess at 3:30 p.m.

4 ---On resuming at 3:45 p.m.

5 THE REGISTRAR: Please come to order.

6 This hearing is again in session. Please be seated.

7 THE CHAIRMAN: Mr. Mondrow?

8 MR. MONDROW: Thank you, Mr. Chairman.

9 Q. Mr. Daly, just before the break you  
10 mentioned that Exhibit 148C, the common mode numbers in  
11 there, were the last published edition of those  
12 numbers. Are there other numbers that we could have  
13 access to that would update those numbers that haven't  
14 been published yet.

15 MR. DALY: A. I am not aware of any  
16 further publication, but since we have an undertaking  
17 on this, if there is a further published set, I could  
18 add it to that, but I am not aware of any at the  
19 moment.

20 Q. Or any follow-up numbers that you  
21 would be able to supply, whether published or  
22 unpublished, if we could add that to the undertaking.  
23 Thank you.

24 A. Sure.

25 Q. In the context of our discussion just

1 before the break then, I would like to talk about some  
2 common failures for nuclear, some of which will be  
3 perhaps common mode, and we can discuss that as we get  
4 there. But just to set the context, for the rotor  
5 cracks at Darlington are an example of a common problem  
6 for at least the Darlington station; is that fair? It  
7 affects more than one unit?

8 A. It has the potential to affect more  
9 than one unit. Although we have had cracks on both  
10 Units 1 and 2 rotors, the cracks were actually at  
11 different locations. So the problem was not exactly  
12 the same, however, there were similar problems.

13 Q. Have you ever had rotor cracking like  
14 that before in any of your other facilities, nuclear or  
15 non-nuclear?

16 A. On the nuclear side I can't recall  
17 any as significant as that. I have no experience on  
18 the fossil side.

19 MR. PENN: A. I don't recall, in my  
20 knowledge, cracks in generator rotors on nuclear or  
21 fossil as long as I have been involved.

22 Q. Do you know why those rotors cracked,  
23 Mr. Penn, what caused it?

24 A. Well, it was a design that ABB, Brown  
25 Boveri, put forward that caused a greater flexing of

1 the rotor itself than was desirable, and at high  
2 intensity stress points these cracks developed. And  
3 the fix of course which is fully successful, beefed up  
4 those areas of flexibility, increased the diameter of  
5 the rotor.

6 Q. Those rotors are hollow; is that  
7 right?

8 A. Not in my knowledge. They are solid  
9 steel.

10 Q. I guess I am curious why these rotors  
11 as opposed to any rotors you have ever used, have  
12 developed cracks. What was different about this  
13 design? Do you know that? Was it the size?

14 A. It was a relatively recent design by  
15 Brown Boveri. I am not a sufficient expert in this  
16 field to say much more except that the company and  
17 Hydro, independently, did very detailed three  
18 dimensional stress calculations and we proved to  
19 ourselves without doubt what the problem was. It's  
20 like any other problem, once you understand it, the  
21 solution generally follows easily.

22 Q. Are these rotors bigger than any  
23 other rotors that Hydro uses?

24 A. Yes, they are. Yes.

25 Q. Mr. Penn, you also testified last



1 week about a delay in Pickering "B" of two years  
2 because of manufacturer faults in the steam generators  
3 there, there was an incorrect stress-relieving process  
4 and the boilers had to be completely refurbished.  
5 Would that be another example of a common problem on  
6 one of your nuclear plants?

7 A. Well, it was a manufacturing fault.  
8 I don't know whether I would call it a common problem.  
9 It was an inappropriate or incorrect annealing process  
10 that was done in B&W's factory in Cambridge, Ontario.  
11 And, of course, like the rotors, the company was liable  
12 to pay for the repair.

13 Q. The company didn't reimburse you for  
14 the cost of the delay, just the repair of the  
15 equipment; is that right?

16 A. No. As I testified before,  
17 contracting major equipment with clauses involving  
18 consequential damage of that nature is not possible.

19 Q. That affected all the "B" units at  
20 Pickering, simultaneously. That would be a common mode  
21 failure in the classic sense; is that right?

22 A. It held up the construction for a  
23 period of two years while Babcock and Wilcox, with the  
24 assistance of B&W U.S., remanufactured the steam  
25 generators.



1 Q. Mr. Daly, you have spoken about steam  
2 generator tube leaks at Bruce 1, I believe, you said  
3 there was a water chemistry problem. Can you describe  
4 where those tubes are leaking, please?

5 MR. DALY: A. On Bruce 1 most of the  
6 leaks have been around what we call the broach plate  
7 area, these are plates which are used to separate the  
8 tubes, and there is, I think, seven levels throughout  
9 the height of the boiler, and deposits have been  
10 tending to collect on those tubes, and we have been  
11 getting some failures in that area.

12 We had earlier failures I guess around  
13 the mid-70s at the top of the U-bend which is right at  
14 the top of the steam generator. These tended to be a  
15 small number and the problem did not recur.

16 So our problem at the moment is the  
17 deposits clogging up the broach plates leading to  
18 stress on the tubes.

19 Q. And these tubes, do they carry heavy  
20 water from the reactor coolant water?

21 A. Yes, the tubes carry heavy water, and  
22 on the side, on the shelf side is the demineralized  
23 water.

24 Q. So those leaks would cause irradiated  
25 heavy water to mix with the light water on the other

1 side?

2 A. That's correct. There are limits on  
3 what size of leak is acceptable, tolerable, and if the  
4 leakage rate gets beyond that, the unit is forced to  
5 shut down. That is, in fact, what happened on a number  
6 of occasions on Bruce 1 and 2, particularly in the last  
7 quarter of last year.

8 Q. Have you had steam generator problems  
9 or steam generator leaks on other nuclear stations,  
10 other than Bruce 1?

11 A. Pickering has had excellent  
12 experience. There has been on Pickering "B" and Bruce  
13 "B", a small number, very small number of leaks on both  
14 those units for slightly different reasons. Bruce "A"  
15 is the unit where we have had the most difficulty.

16 Q. Do you know, in your knowledge, if  
17 there are similar steam generator problems in fossil  
18 stations?

19 A. I can't really speak for fossil  
20 stations.

21 I think the chemistry, the temperature of  
22 the pressure is significantly different. Certainly on  
23 nuclear units there have been around the world similar  
24 types of problems.

25 Q. So that steam generator problems like

1 that could be common problems in the context of  
2 nuclear; is that fair?

3 A. Well, they are common in the sense  
4 that if you don't maintain good chemistry and repair  
5 and plug tubes when you should, you will get leaks.  
6 Probably over the life of the station you would  
7 certainly expect a few that you would have to plug and  
8 repair.

9 So it's a common, yes, a common problem  
10 and what we do is try to minimize the impact that that  
11 has in the plant through inspection and maintenance  
12 problems.

13 Q. We have heard about the infamous G16  
14 incident, the 1983 rupture in Pickering "A" which has  
15 led to many outages planned and unplanned. Pressure  
16 tube degradation is also a common problem with nuclear;  
17 isn't it?

18 A. That's correct. The G16 incident did  
19 lead particularly to -- you mentioned that it led to a  
20 lot of planned and unplanned outages. I think I would  
21 qualify that a bit. I think it led more to an  
22 increasing amount of planned outages, because as a  
23 result of that unplanned outage we were forced to  
24 retube the reactors, of course, Units 1 and 2, but we  
25 also learned a lot from that. Since that time the

1 pressure tube situation has gone to a much more planned  
2 basis since that time.

3 Q. In fact, when you retubed 1 and 2 I  
4 believe they were both out at the same time; is that  
5 right?

6 A. They were out most of the period  
7 concurrently, the first unit took five years and the  
8 second unit four years.

9 Q. So that would be again a classic  
10 definition of common mode failure; is that fair?

11 A. Well, I think it is more of your  
12 common problem method of describing it, because the  
13 Unit 2 incident occurred in August of '83 and the unit  
14 was forced to shut down immediately, however Unit 1 ran  
15 for a period of time until about November of '83 and it  
16 was decided, based on what we knew at that time, that  
17 that unit had to be shut down. So they didn't shut  
18 down instantaneously together.

19 Q. In fact, one might say that there  
20 several problems involved or subsumed in the pressure  
21 tube problems. First, there were too few garter  
22 springs in your initial problem, and that a common  
23 problem with a number of your stations; right?

24 A. That was a common problem with the  
25 first six units, the four Pickering units and Bruce 1

1 and 2.

2 Q. And secondly the springs have shifted  
3 and that's a common problem?

4 A. That was a common problem with the  
5 earlier designs, and having realized that, different  
6 procedures were put in place to put the springs in  
7 place.

8 Q. And you are having some problems with  
9 that relocation procedure, you have testified to that.

10 A. Some of the springs in some of the  
11 channels have proved difficult to move, other springs  
12 are easy to move.

13 We will be doing our first full scale  
14 SLAR operation later this year in one of the Bruce  
15 units.

16 Q. And then the tubes sag, that is a  
17 third common design problem with the pressure tubes; is  
18 it that fair?

19 A. The tubes do sag slowly over a period  
20 of time. Again, the amount of sag can be fairly easily  
21 measured, and you have to do appropriate maintenance  
22 which in some cases may be the retubing of a total unit  
23 if the tubes take a long period to sag.

24 If they prove to be sagging unduly then  
25 individual pressure tubes can be replaced. So the



1 amount of sag determines what the appropriate  
2 maintenance program is.

3 Q. And the tubes elongate and in fact  
4 you they elongated more than you expected they would.  
5 That is a another common problem with pressure tubes;  
6 is that right?

7 A. That's true, particularly of the  
8 earlier units, but with all common problems, they also  
9 do lead to a number of common solutions.

10 So having solved a number of these  
11 problems which turned up on the older units, this gives  
12 us more confidence about the later units where we have  
13 realized we have had a problem such as growth or  
14 inadequate number of garter springs or steam generator  
15 chemistry, so realizing we have had those common  
16 problems we have put in what you might call common  
17 solutions and that's what gives us greater confidence  
18 in the later units.

19 Q. Just to finish up with the tubes.  
20 The fifth problem is the hydriding problem, which, Mr.  
21 Penn, you have testified a couple of times is really  
22 separate factors involved in that problem. But the  
23 problem is exacerbated, if I understand your testimony  
24 by the thermal gradient between the fuel channel and  
25 the calandria tube, and you have now changed the



1 annulus insulation system, I believe, to compensate for  
2 that.

3 MR. PENN: A. I don't think you  
4 understand the issue. As I have stated - and I guess  
5 this is the third time - that to get pressure tube  
6 failure you need three common conditions occurring  
7 simultaneously and you have just picked on one of them.

8 Q. Yes. I will interrupt you for a  
9 second, and I will let you finish, I promise, but I  
10 thought I said in my question there are a number of  
11 factors involved and one of them is the temperature  
12 gradient. You can repeat your evidence if you like,  
13 but I think I have at least a rudimentary understanding  
14 of your testimony.

15 It's right to say that one of the factors  
16 in that hydriding of hydriding problem is the  
17 temperature gradient problem. You have addressed that.

18 A. You have mentioned one of the  
19 conditions necessary, yes.

20 Q. There are two others.

21 A. And there are two other, yes.

22 I would like to add a little bit to what  
23 Mr. Daly said.

24 Q. Please.

25 A. When you talk about common problems,

1 I think it would be inappropriate to leave the view  
2 that these are issues or problems common to all our  
3 reactors. For example, the steam generators, there are  
4 three different designs in our system: There is the  
5 design at Pickering "A" that has operated now for  
6 nearly 21 years without the slightest problem; there is  
7 a design at Bruce plants which has caused us problems  
8 at Bruce "A", and there is a change in design at  
9 Darlington to avoid that problem at Bruce "A".

10 [4:03 p.m.]

11 As far as the pressure tubes are  
12 concerned, as we said before that not only have we  
13 increased the number of garter springs but we changed  
14 the design so that they are tight-fitting and can't  
15 move; in all the "B" reactors, including Bruce 4.

16 If you go further to some of your other  
17 examples or one that you haven't mentioned, condensers,  
18 we have changed the alloy in the tubing in some of our  
19 plants.

20 So while the points you have made -- and  
21 the only difficulty we have had with SLARing is with  
22 the two-spring situation where the springs have been so  
23 far apart that it has been very difficult to separate  
24 the calandria tube and pressure tubes so that you could  
25 easily move them. But that isn't the case in the other

1 reactors.

2 Q. Mr. Penn, has Ontario Hydro done an  
3 historical accounting of all the pressure tube outages  
4 to date, major, minor, planned, unplanned, that we  
5 could look to somewhere?

6 MR. DALY: A. We have done that  
7 accounting, and I think perhaps my direct evidence  
8 might be the best place. If you look at Exhibit 519  
9 page 24--

10 Q. Yes, I have that.

11 A. --that shows the system  
12 incapability -- actually, this is just over a period  
13 1987 to 1991, but you can see the incapability due to  
14 fuel channels during that period. It clearly was -  
15 over that five-year period - it was the dominant  
16 contributor to incapability, being close to 10 per cent  
17 incapability over that period.

18 Q. Could I get an undertaking to have  
19 the numbers and a disaggregation of those numbers, an  
20 itemized list of when they occurred and how long the  
21 outages were that went into that average figure? Is  
22 that something that you can provide?

23 MR. B. CAMPBELL: Mr. Daly, is that  
24 readily available?

25 MR. DALY: Yes, I believe it is. We have

1       tabled in another interrogatory all the outages, and it  
2       would just be a selected number of those.

3               THE CHAIRMAN: Is that 9.7.148, is that  
4       the interrogatory? It is the one that you derived this  
5       table from? Maybe not.

6               MR. DALY: No. No, it is not. It is  
7       another interrogatory.

8               MR. MONDROW: If you could undertake to,  
9       if it is available, provide with us that information,  
10      please?

11              THE CHAIRMAN: Well, if it is in the  
12      interrogatory that is where it is. We just have to  
13      find the number of the interrogatory.

14              MR. B. CAMPBELL: I am advised that it is  
15      9.2.123. Perhaps my friend could check it tomorrow. I  
16      believe that is the correct number.

17              MR. MONDROW: We will check that, Mr.  
18      Chairman. Thank you.

19              THE CHAIRMAN: 9.2.123?

20              MR. B. CAMPBELL: I believe that is the  
21      number. That is what I am advised.

22              THE REGISTRAR: 9.2.123 is .104.

23              THE CHAIRMAN: Thank you.

24              MR. MONDROW: Q. Mr. Daly, will that  
25      interrogatory, do you know, give us a projection for

1 the estimated future frequencies and durations for  
2 pressure tube outages, for inspection as well as  
3 replacement?

4 MR. DALY: A. I don't believe that  
5 particular one would give you it.

6 Q. Do you have that information?

7 A. The retubing schedule has been  
8 provided under 9.2.78. Also, Mr. Penn's direct  
9 evidence gave the retubing schedule.

10 THE CHAIRMAN: I'm sorry, could you give  
11 me that again? I'm sorry.

12 MR. DALY: 9.2.78.

13 THE CHAIRMAN: Yes?

14 MR. DALY: Retubing Schedule.

15 MR. MONDROW: Q. Yes, I am aware of that  
16 schedule. I am interested in outages for inspections  
17 and any patching that you project could be necessary  
18 based on your past experience pending the large scale  
19 fluid channel replacement. Have you done that  
20 analysis?

21 MR. DALY: A. We have done that out for  
22 the next six years. I don't believe you would find it  
23 in any of the interrogatories we have tabled here, but  
24 we do that regularly for the consistent energy set  
25 process.

1 THE REGISTRAR: Is 9.2.78 to be given a  
2 number?

3 THE CHAIRMAN: If it hasn't got one  
4 already.

5 THE REGISTRAR: Yes, .126.

6 THE CHAIRMAN: Thank you.

7 ---EXHIBIT NO. 520.126: Interrogatory No. 9.2.78.

8 MR. MONDROW: Q. If we could get the  
9 last information, the six-year projection that you have  
10 just referred to, please, as an undertaking, if it is  
11 available?

12 MR. DALY: A. Yes.

13 THE CHAIRMAN: Is that all right, Mr.  
14 Daly?

15 MR. DALY: Yes, it can be done.

16 THE CHAIRMAN: Better give it a 532  
17 number.

18 THE REGISTRAR: 532.13.

19 ---UNDERTAKING NO. 532.13: Ontario Hydro undertakes to  
20 provide six-year projection for  
21 outages for inspections and any  
22 patching necessary based on past  
- experience pending the large scale  
fluid channel replacement.

23 MR. MONDROW: Thank you.

24 MR. B. CAMPBELL: Mr. Chairman, if my  
25 friend would see me at the end of the day I have been



1 provided with certain other interrogatory references  
2 that give a variety of information about outages. This  
3 has been covered in a range of interrogatories, so I  
4 might as well give him the complete set at the end.

5 THE CHAIRMAN: Sure.

6 MR. MONDROW: That would be helpful.  
7 Thank you, Mr. Chairman.

8 Q. Mr. Penn, fueling machines, would you  
9 agree that they are complex pieces of equipment?

10 MR. PENN: A. Yes, but they were  
11 developed, of course, by Canadian General Electric and  
12 by Standard Modern more than 25 years ago.

13 Q. And the software that runs them,  
14 would you agree that that is pretty complex software?

15 A. I'm not personally familiar with the  
16 details of the software in them. I don't know if Mr.  
17 Daly knows the extensiveness of it. I would be  
18 surprised if they were particularly sophisticated in  
19 modern standards. After all, they have been in use for  
20 many years.

21 Q. Could you turn, please, to page 2 of  
22 our interrogatory package? This is Interrogatory  
23 9.2.39, and I believe it has yet to be given a number,  
24 Mr. Lucas.

25 THE REGISTRAR: That will be .127.

1       ---EXHIBIT NO. 520.127: Interrogatory No. 9.2.39.

2                       MR. MONDROW: Q. Attached to this  
3       interrogatory is a table that lists fueling machine --  
4       -- actually, Fuel Handling System: Net Electrical  
5       Incapability, is the title of the table. And I believe  
6       it is limited to 1990, as you will see in the response  
7       on the cover page.

8                       MR. DALY: A. Yes, that's correct. It  
9       is limited to 1990.

10                      Q. If we look under the Remarks column  
11       for Pickering "A" I see three references to fueling  
12       machine stuck on channel.

13                      That would be a common problem, then, of  
14       the fueling machine for that year. Mr. Daly, is that  
15       fair?

16                      A. That occasionally happens during  
17       fueling, and, as you see, there were three instances  
18       there during the year on Pickering.

19                      Q. And if we look under Bruce "A" there  
20       is a reference to fueling machine bridge brake failure.  
21       That would be on Bruce 2, I guess. Is that the same  
22       problem? Is that a sticking problem?

23                      A. No, that is a different problem. The  
24       bridge moves the machine up to the correct position on  
25       the reactor. So there is a distinction between the

1 fueling machine as stuck on the end of the channel and  
2 the bridge. The bridge moves the machine and a number  
3 of problems have occurred with the bridge, so that the  
4 bridge problems are distinct from the fueling machine  
5 stuck on channel type of problem.

6 Q. In the first case the fueling machine  
7 is stuck itself, and in the second case it is stuck on  
8 the fuel channel; is that right?

9 A. Well, there can be a number of  
10 different types of failures associated with the bridge.

11 This particular problem with Bruce "A"  
12 was a problem with the brakes which are used to slow  
13 the bridge down.

14 The other problems are problems where the  
15 fueling machine locks on to a fuel channel but for some  
16 reason it cannot be locked off, and in some cases this  
17 will require a short outage to fix.

18 Q. And if we look under Pickering "A"  
19 for Pickering 1, the second entry there, we have fuel  
20 machine bridge leveling problems, and under Pickering  
21 "B" we have fuel machine bridge tilt. Is that the same  
22 problem?

23 A. A similar type of problem, yes. We  
24 had, I think, two instances that year, I would not  
25 regard them as completely identical, there were some

1 different circumstances, but they were similar types of  
2 problems.

3 Q. Okay. And for Bruce "A", the last  
4 entry, we have a fuel handling system software error.  
5 Can you elaborate on that?

6 A. Yes. This was a major outage, and I  
7 believe it has been referred to earlier in testimony.  
8 There was a software error while working on one of the  
9 fueling machines which led to the inadvertent movement  
10 of a fueling machine which was connected to a channel,  
11 I believe it was channel C08. So that caused the  
12 fueling machine to move downwards - about 10 to 12  
13 inches, is my recollection - causing a leak of heavy  
14 water from the heat transport system and leading to  
15 damage particularly to the end fitting of the fuel  
16 channel, and that led to approximately a five-month  
17 outage.

18 Q. Is that the incident that was  
19 discussed with Mr. Poch I guess it was last week?

20 A. I believe it was --

21 Q. Mr. King, I think you were discussing  
22 that.

23 A. I think Mr. King had discussed that  
24 with Mr. Poch.

25 Q. Is that the same incident, Mr. King?

1 MR. KING: A. Yes, it was.

2 Q. Thank you. Moving over to the  
3 deratings column in the Remarks column under Bruce "B"  
4 we have stuck fueling machine. So that is the same  
5 problem, then, as at Pickering "A", we saw three stuck  
6 fueling machines; is that right?

7 MR. DALY: A. That's correct. And in  
8 part this reflects a problem I had identified earlier  
9 that we have been experiencing a backlog of  
10 maintenance. Fueling handling was one area that was  
11 affected. The maintenance wasn't as up to par as we  
12 would have liked it.

13 If you look at our history with fuel  
14 handling, fuel handling has normally not contributed  
15 much to incapability. So it was a bit of a surprise  
16 and a setback for us that we had so much in 1990.

17 As a result of that, the maintenance area  
18 in particular was improved, particularly at Pickering,  
19 and in 1991 the fuel handling incapability was only .17  
20 per cent. So there was significant improvement made as  
21 a result of the incidents we had in 1990 to strengthen  
22 the maintenance, the maintenance effort on fuel  
23 handling.

24 Q. The overheads that you showed us,  
25 Exhibit 519, you just took us to an overhead, and that



1 had a fuel handling incapability, and just eyeballing  
2 it, it is about 1.8 per cent for those years. Is that  
3 your recollection of the figure?

4 A. That would be about--

5 Q. Is that about right?

6 A. --right, I think, over the five  
7 years. It was quite well down the list.

8 Q. And the last thing on this chart,  
9 please, it says, both under Pickering "A" and Pickering  
10 "B", various minor breakdowns.

11 Can you tell us what those were? Some of  
12 those deratings appear fairly significant. Were any of  
13 them common types of problems?

14 A. I think these are the chronic type of  
15 things that typically result from lack of optimum  
16 maintenance, you know, failures to rams and seals and  
17 valves, and nothing particularly major, just an  
18 accumulation of chronic type things, which is an  
19 indication that your maintenance isn't what it should  
20 be and why we had to increase the maintenance effort.

21 Q. The one other thing that you have  
22 common to both Pickering "A" and Pickering "B" in that  
23 column is a shortage of fuel handling operators. Would  
24 that be a common problem, shortages of trained staff  
25 for nuclear?



1                   A. That was a common problem, and it was  
2                   recognized back in 1988, and Mr. Penn and myself have  
3                   both testified to this.

4                   It was as a result of recognizing this  
5                   common type of problem related to lack of resources  
6                   that the Nuclear Hiring Program was initiated. So as  
7                   operators and maintainers are trained and come out of  
8                   that program fuel handling is one area to which they  
9                   are going and will continue to go.

10                  Q. When you say shortage of trained  
11                  operators does that just mean that you just wouldn't  
12                  use the machine if you didn't have someone there to run  
13                  it? I am not clear what that means.

14                  A. Yes, you can only run a machine with  
15                  an operator who has been trained on the fuel handling  
16                  machine. So there is a certain level of qualification,  
17                  and it is a reasonably high level.

18                  Q. So you would have to wait for those  
19                  people to get to the particular unit to operate the  
20                  machine before you could bring the power back up and  
21                  replace the fuel in essence?

22                  A. You know, we always have enough  
23                  operators to, you know, fuel one or two units, but you  
24                  might have one unit that gets a little bit behind. So  
25                  it has been one of our concerns.

1 Q. So we had a stuck fueling machine  
2 problem, and there was a tilt problem, and operator  
3 shortages. The other things we have discussed, these  
4 were all problems with the fuel handling system. In  
5 that sense these were common problems for nuclear; is  
6 that a fair statement, do you think, Mr. Daly; the  
7 fuel handling system has presented problems?

8 A. Well, all nuclear reactors have fuel  
9 handling system types of one sort or another. Many of  
10 the problems we discussed here are of a fairly routine  
11 nature. Others are more major and specific, like the  
12 Bruce 4 incident. But it is common in the sense that  
13 problems on a coal station associated with coal firing  
14 would be common to a coal station.

15 Q. Okay. So fueling machines in the  
16 nuclear context has been historically a problem as far  
17 as deratings and outages?

18 A. Well, historically, no. No. No.  
19 Historically, as I said, up to fairly -- up until 1990  
20 our incapability was generally pretty low, of the order  
21 of 1 to 2 per cent.

22 Q. Yes.

23 A. 1990 was a bad year; 1991 was a  
24 significantly improved year.

25 Q. If you could turn to page 7, please,

1 of Exhibit 647? First, I should tell you Mr. Marcus  
2 advises me that there is a copying error in this table.  
3 This is page 7 of Exhibit 647, Nuclear System Fuel  
4 Handling Incapability, 1990.

5 We have just taken the numbers from this  
6 table and calculated out for the system the  
7 incapability, but, as I say, there is an error under  
8 the Fueling Handle Incapability column. The last entry  
9 should be 19 gigawatthours for Bruce "B".

10 THE CHAIRMAN: What page are we on, I'm  
11 sorry?

12 MR. MONDROW: Page number 7 of Exhibit  
13 647.

14 THE CHAIRMAN: Yes? And what should be  
15 19? What is it now?

16 MR. MONDROW: In the second column under  
17 Fuel Handling Incapability, the last number, the number  
18 for Bruce "B" should be 19 gigawatthours. It is now  
19 4953. That is just a copying error though; it does not  
20 affect the percentage in the Fuel Handling Incapability  
21 Factor column of .06 per cent. That number is still  
22 accurate based on this information.

23 THE CHAIRMAN: So all the numbers in that  
24 column add up to 4953; is that right?

25 MR. MONDROW: That's right.

1 MR. DALY: Just while we are on that  
2 column, Mr. Mondrow, there is another small error. On  
3 Bruce "A", middle figure, it should be 2867, I think  
4 you would agree.

5 MR. MONDROW: Q. Okay. Thank you.

6 MR. DALY: A. So I make the total 4991,  
7 which, as you say, it is pretty close to the total you  
8 have there.

9 Q. Okay.

10 A. The other point I would make about  
11 the table is on Pickering "A" you have calculated the  
12 fuel handling incapability factor based on just three  
13 Pickering units. I think there was one unit down for a  
14 retubing.

15 Q. That's right.

16 A. When we do this type of calculation  
17 we normally do it on a four-unit basis. This then lets  
18 us compare everything across the station on a  
19 consistent basis as a percentage of the total station  
20 incapability, which would change your 9 per cent to  
21 about 7 per cent. It is a small change, but that would  
22 be normally the way we would calculate total station  
23 incapability.

24 Q. So the 5.56 overall per cent total  
25 would be somewhat less due to the adjustment you have

1 just mentioned on a four-unit basis and a little bit  
2 more for the correction you have made to the Bruce "A"  
3 number in column 2?

4 [4:24 p.m.]

5 A. That's correct. It would probably  
6 still be around 5 per cent. Your number is pretty  
7 close.

8 Q. So, generally, 1990 wasn't a great  
9 year relative to your historical experience. And we  
10 talked about a figure of 1.8 per cent over the years  
11 that you have done your computing.

12 A. Right. So we compare that 1 to 2 per  
13 cent with the 5 per cent in 1990, and as I was saying  
14 about .2 per cent in '91.

15 Q. Right. As a matter of fact, in ONCI,  
16 I believe, the Ontario Nuclear Cost Inquiry, Ontario  
17 Hydro stated that it was confident that fueling related  
18 incapability would be less than 1 per cent for a future  
19 station. But for 1991 that doesn't accord with your  
20 historical experience.

21 A. Well, that's '91. I mean you have to  
22 look at that year in the context of the 20, 21 years of  
23 experience. I'm pretty sure the historical number over  
24 the 20-year period would be 1 per cent or less..

25 And certainly with the future station

1 that ONCI was talking about, you know, we would  
2 certainly expect to learn that we have got to apply  
3 more maintenance effort to fuel handling and, you know,  
4 correct the type of software error that led to this  
5 type of error at Bruce "A." So, in ONCI we are taking  
6 some credit from learning from our experience.

7 MR. MONDROW: If we could go, please, to  
8 our interrogatory package, or stay with our  
9 interrogatory package, at page 5 we have the cover  
10 sheet for Exhibit 9.2.7, which I don't believe has been  
11 given a number yet. Mr. Chairman.

12 THE REGISTRAR: 128.

13 ---EXHIBIT NO. 520.128: Interrogatory No. 9.2.7.

14 MR. MONDROW: Q. And in response to that  
15 exhibit, as you can see, there was attached a number of  
16 annual staff reviews, AECB staff reviews for the  
17 various stations. I've just copied excerpts, the  
18 excerpts that I want to take you to.

19 That's what you'll find in our package.  
20 Page 6 of our package is the cover sheet for AECB staff  
21 review of Darlington "A" operation for the year 1990.  
22 If you could turn to page 8 of our exhibit, which is  
23 page 2 of that review -- I'm sorry. I think I have the  
24 wrong page. It's page 9, please, that I'm interested  
25 in.



1 The third paragraph, it says,

2 In October, during commissioning of  
3 Unit 1... this would be Darlington, of  
4 course...fueling, machine bridge and  
5 carriage of movement of the Unit 1 west  
6 carriage was requested but the Unit 2  
7 west carriage moved instead. The fault  
8 was traced to a defect in the software  
9 which had been used to compile data for  
10 all fuel handling units.

11 In fact, in the next paragraph we see,  
12 about halfway through the first sentence, A similar  
13 software error in the fuel handling control system at  
14 Bruce Nuclear Generating Station in January, 1990,  
15 caused damage to a channel end feeding into a heat  
16 transport system leak.

17 Mr. King, this is the same incident,  
18 then, I would take it that you discussed with Mr. Poch,  
19 the second reference?

20 MR. KING: A. I believe it is.

21 Q. Okay. My point, though, really is  
22 that this was, in fact, the same problem. And it was  
23 traced to the compilation of the fuel handling  
24 software. Can you confirm that, please, Mr. Daly?

25 MR. DALY: A. I can't confirm that it

1 was exactly the same problem. Clearly there is some  
2 similarities. I'm not familiar enough with the details  
3 of Darlington. I'd be surprised if it was exactly the  
4 same type of problem.

5 However, let me point out that it was  
6 during commissioning of Unit 1, and it's not uncommon  
7 to get surprises during commissioning. That's why you  
8 do commissioning, to sort out all the bugs in the  
9 system. However, clearly that was a significant one  
10 and is of concern.

11 Q. The AECB has identified the error as  
12 similar to the one that occurred in Bruce in January of  
13 1990. So it was their opinion that it was a pretty  
14 close problem. You would agree with that, I guess.

15 A. Yes.

16 Q. Computers are involved, I would  
17 imagine, in a lot of aspects of the operation of  
18 Hydro's nuclear reactors. Mr. Penn, you mentioned the  
19 complexity or lack thereof of software systems a little  
20 earlier. Can you confirm for me that computers are  
21 involved in, first of all, daily operations, what you  
22 have referred to as process systems?

23 MR. PENN: A. Yes.

24 Q. And emergency systems, as well?

25 A. I'm not familiar with that. Maybe

1 Mr. King has that knowledge.

2 Q. Mr. King, do you use computers for  
3 emergency systems?

4 MR. KING: A. It depends what systems  
5 and what plants.

6 Q. Some of the systems do?

7 A. Excuse me?

8 Q. Some of the emergency systems use  
9 computers?

10 A. Yes. With the newer plants there is  
11 more extensive use of computers in safety systems.

12 Q. And for testing and monitoring, Mr.  
13 Daly, do you use computers, as well?

14 MR. DALY: A. We do, yes.

15 Q. And for training, as well, I would  
16 imagine; computer simulations and so forth?

17 A. Yes. We have major simulators for  
18 all our plants.

19 Q. Is there any other major aspect of  
20 operations that you can identify for me that you use  
21 computers in, particularly dependent on computerized  
22 systems?

23 A. Well, computers are coming in more  
24 and more to all aspects of the plant: Procurement,  
25 ordering spare parts, technical system analysis, work

1 management. And just as technology is changing and  
2 computers are becoming more widespread. And the same  
3 thing is going on at the nuclear generating stations.

4 Q. Could you turn, please, to page 8 of  
5 Exhibit 347. I have copied an article here, the next  
6 two pages, pages 8 and 9, from Science News, Volume  
7 140. That was in December of 1991. I would like to  
8 put a few passages for your comment, please.

9 Mr. Daly, if you go to the bottom of the  
10 first column in the article, we see the comments of two  
11 NASA computer scientists. And they say, in quotes:

12 We want to use digital processors in  
13 life-critical applications but we have no  
14 feasible way of establishing that they  
15 meet their ultra-reliability  
16 requirements.

17 Do you agree with that statement?

18 A. Sir, I haven't found it yet.

19 Q. Certainly, I'm sorry. It's page 8,  
20 Exhibit 647. And the article I'm concerned with is the  
21 Software Failure article. It's at the bottom right  
22 corner of the page. If you go to the bottom of the  
23 first column, it will refer to a Mr. Butler. I think  
24 it's a Mr. Butler and a Mr. Finale of NASA, two  
25 computer scientists, and they say:

1                   We want to use digital processors in  
2                   life-critical applications but we have no  
3                   feasible way of establishing that they  
4                   meet their ultra-reliability  
5                   requirements.

6                   Do you agree with that statement?

7                   A. I really can't comment. I'm not an  
8                   expert in the computing field. I know extensive  
9                   testing is certainly required of software, but I'm  
10                  really not an expert in that field.

11                  Q. Can anyone else comment? Mr. King?

12                  MR. KING: A. You are asking if in NASA,  
13                  that NASA doesn't have any feasible way to show this?

14                  Q. No. There is a concern expressed in  
15                  this article that there is no feasible way to ensure  
16                  the operation of life-critical computer systems. And  
17                  I'm asking if you agree with that.

18                  A. We don't use the word "life  
19                  critical." We use a term "safety-critical software,"  
20                  and we have programs to ensure the reliability of that  
21                  software up to the degree of reliability that we need,  
22                  as I was referring to, in some special safety systems.  
23                  For example, the Darlington shutdown system software.  
24                  We use computers to shut down the plant. And we have  
25                  developed methods to provide that level of assurance on



1 the reliability of that software.

2 Q. We go to the second column. Near the  
3 middle of the first full paragraph, there is a paper  
4 that was presented, and the paper is reported to have  
5 said, "Without a major change in the design and  
6 verification methods used for life-critical situations  
7 major disasters are almost certain to occur with  
8 increasing frequency."

9 I take it from your comments, Mr. King,  
10 you would disagree with that statement in the context  
11 of nuclear.

12 A. Well, they are saying without a major  
13 change. A change from what? I'm not sure in this  
14 paper what they were referring to as the initial state.  
15 There has certainly been advances over the past 18  
16 months. I know on Ontario Hydro we have developed a  
17 standard for the writing of safety-critical software  
18 which has been accepted by the AECB, and we are using  
19 it right now for the design of any new safety-critical  
20 software.

21 Q. Did you have confidence in the system  
22 you were using before for the design of safety-critical  
23 software, before the last 18 months?

24 A. The issues that came up, and I'm not  
25 sure whether you are familiar with the Darlington



1 shutdown system software issue, but it was a very major  
2 issue in the licencing of Darlington, where, because of  
3 the complexity of the software, the way it was written,  
4 it was very difficult to show that it had sufficient  
5 reliability.

6 We went through very extensive efforts to  
7 convince the control board that, in fact, it was  
8 reliable software. But in future, there are better  
9 ways to write that software to make it easier to update  
10 and not introduce any problems when you update that  
11 software. But Darlington was really the first time  
12 where we used software in special safety systems in  
13 Ontario Hydro.

14 [4:35 p.m ]

15 Q. But software was used in process  
16 systems, I think you called them, before that?

17 A. The plant control computer which  
18 drives the regulating system which drives your reactor  
19 power up and down and a number of other control aspects  
20 of the plant, that of course is written in software,  
21 and Pickering has been using that since 19 -- since it  
22 started in 1971.

23 The Canadian experience in using  
24 computers to run nuclear stations, we have more  
25 experience than anyone else in that area.

1 Q. Would you call that a life critical  
2 application for the software?

3 A. No. No, I wouldn't. Because in our  
4 safety analysis we don't take any credit for the  
5 correct operation of that software.

6 In the fact, we assume that we have loss  
7 of regulation accidents where that software can drive  
8 all the reactivity devices in their most -- in their  
9 worse direction, and hence tend to increase power at  
10 the fastest rate, and we have to assume that as one of  
11 our safety analysis cases. In that situation the  
12 special safety systems have to respond accordingly.

13 Q. I would like to ask you to comment on  
14 one more passage here. On page 9 of the exhibit, the  
15 end of the third column, the sentence beginning, "For  
16 example."

17 A. Sorry, I haven't found you yet.

18 Q. Third column, it is just near the  
19 end -- about midway through the third full paragraph,  
20 it starts, "For example."

21 A. The left-hand column?

22 Q. Left-hand column.

23 A. The first column.

24 Q. First column. I'm sorry if I  
25 misspoke myself.

1                   For example, software design often  
2                   involves a repetitive cycle of testing  
3                   and repair in which the program is tested  
4                   until it fails. Testing resumes after  
5                   the cause of failure is determined and  
6                   the fault repaired. But it generally  
7                   takes longer and longer to finally remove  
8                   each successive fault.

9                   In the next sentence there is a reference  
10                  to years, if not decades, of testing on the fastest  
11                  computers available.

12                  Is that how you test your software, Mr.  
13                  King, for the safety systems?

14                  A. We have one computer which keeps on  
15                  generating sets of input parameters for another -- the  
16                  software that you are trying to verify is sitting on  
17                  one computer and you use another computer to generate  
18                  sets of input for the software on the other computer,  
19                  and you just keep on giving it all sorts of varieties  
20                  of inputs to make sure that it can handle any  
21                  situation, any combination of input parameters.

22                  The testing, it refers to in this  
23                  paragraph to a complicated computer program, I am not  
24                  sure what he means, how complicated is complicated in  
25                  his mind.

1 But in the standard that we have  
2 developed for software, one of the crucial issues is to  
3 make your safety critical software as simple as  
4 possible to avoid any -- that makes it much easier to  
5 show that it is reliable. You separate all the  
6 non-safety critical aspects of the software from the  
7 safety critical aspects of the software so that there  
8 is no interaction at all, and that makes it much easier  
9 to show the reliability.

10 Now, it takes us several weeks of testing  
11 to go through the set of tests that we have developed.

12 So, it doesn't seem to be consistent with  
13 what they have in this paragraph, but I can only assume  
14 that he is talking about some very complicated  
15 software.

16 I should also mention, if we are talking  
17 about software and the Darlington issue, there is two  
18 shutdown systems at Darlington, shutdown system No. 1,  
19 shutdown system No. 2, both of them are  
20 software-driven, but the software is resident on  
21 different computers on each system. It isn't one  
22 computer; it's two different sets of computers for each  
23 system. The computers are of a different manufacture.  
24 The software is written by different sets of  
25 programmers on SDS 1 and on SDS 2, as well they use a

1 different programming language on SDS 1 and SDS 2.

2 And with respect to some of the other --

3 Q. So just on that point, you have to  
4 test them both separately then, they are different  
5 programs.

6 A. We go through two sets of tests. But  
7 this reduces the likelihood of having common errors in  
8 both SDS 1 as we have introduced a lot of diversity in  
9 the hardware and in the software of the Darlington  
10 shutdown computers.

11 Q. Just to sum this up then. If you go  
12 back to page 8, in the right-hand column of that  
13 article, second full paragraph near the middle, there  
14 is a reference to nuclear power stations.

15 A. Sorry, I haven't got to you yet.

16 Q. It's right column.

17 A. I have it.

18 Q. There is a reference to nuclear power  
19 stations and other activities. Nuclear power stations  
20 is included and is referred to as a realm in which a  
21 software failure can cause tragedy.

22 I take it from your comments, though, Mr.  
23 King, that Ontario Hydro is confident that its software  
24 has been adequately tested and will function when  
25 called upon to do so. You don't share any of the



1 concerns that I have put to you in this article.

2 A. I was giving my comments on what we  
3 have defined as our safety critical software, and your  
4 question just referred to software. Software is used  
5 in many places.

6 I think if you get your safety critical  
7 software very reliable, you are not going to get in the  
8 situations which are described in the sentence you read  
9 to me as tragedy. I assume tragedy means, in my terms  
10 tragedy means fuel failures and large releases.

11 Q. Okay. Thank you.

12 Back to Interrogatory 9.2.7, please. I  
13 have copied page 6 from the Darlington report. We are  
14 on it, as a matter of fact. It's page 9 of my package.  
15 The conclusion of the first paragraph summarize the  
16 problems in 1990.

17 MR. PENN: A. I'm sorry, Mr. Mondrow, we  
18 haven't found out where you are yet.

19 Q. I am on page 9 of our interrogatory  
20 package, which is page 6 of the Darlington report we  
21 were just looking at.

22 A. Okay.

23 Q. In the first paragraph which is the  
24 conclusion of a discussion on fueling mishaps, and  
25 about halfway through the fourth last sentence, it says



1       that the initial fueling mishap -- do you have me, Mr.  
2       Penn?

3                   A. Now you are in the middle of a  
4       sentence now?

5                   Q. That's right.

6                   A. I think we ought to start at the  
7       beginning of a sentence, at least, to understand what  
8       it means.

9                   Q. Okay, if we go up to the fifth last  
10      line.

11                   Although this summarizes the problem  
12                   and follow-up activity to the end of  
13                   1990, it should be added that the initial  
14                   fueling mishap was subsequently  
15                   discovered to be a direct result of  
16                   cracked fuel bundle end-plates. The  
17                   mystery surrounding the end-plate damage  
18                   has yet to be resolved and has resulted  
19                   in extensive outages for both Units 1 and  
20                   Units 2.

21                   So the Darlington end-plate damage is a  
22       common mode problem, it's keeping both units down; is  
23       that fair?

24                   A. Yes. As we gave, Mr. Daly gave  
25       extensive direct evidence on this and I have referred

1 to it, it's related to the pulses, 150 a second -- a  
2 minute, a 150 a minute, from the main PHT pumps. And  
3 because the pumps in both reactors are the same type,  
4 then the problem is similar.

5 Q. In fact, it is keeping all four units  
6 down right now; isn't it? You said that that's your  
7 major concern at Darlington, is that --

8 A. We haven't finished building Unit 4  
9 yet, that's that unit taken care of. And Unit 3 has  
10 never gone critical, it's about to soon, this fall.

11 Q. Providing you solve this problem.

12 A. Yes. And we will know by July.

13 Q. But the file isn't closed on this  
14 mystery; is that fair?

15 A. No, but we have other provisions to  
16 cope with the problem, as I mentioned before, changes  
17 in the primary circuit.

18 Q. I am looking at the second paragraph  
19 on that page. The board staff says:

20 On March 22, 1991, Ontario Hydro made  
21 a formal request to the AECB for approval  
22 to restart Unit 1. The request was  
23 denied on the basis that Ontario Hydro  
24 clearly did not understand the cause or  
25 extent of the reactor core damage.

1 Do you agree with that statement, Mr.

2 Penn?

3 A. I think it was that the board wasn't  
4 satisfied at the time -- well, I guess prior to this  
5 being written, middle of last year, so it probably  
6 dates to the spring. Mr. Daly I think is probably more  
7 familiar with the circumstance. But subsequently of  
8 course the AECB did approve restarting Unit 1 and it  
9 operated for several months in '91.

10 Q. Mr. Penn, Unit 3 has not been fueled  
11 yet, I believe you testified to that earlier.

12 MR. DALY: A. Unit 3 has actually been  
13 fueled, yes.

14 Q. It's been fueled. So is Unit 3  
15 radioactive?

16 A. No, Unit 3 has not been taken  
17 critical yet.

18 MR. PENN: A. What we are doing, so that  
19 it is clear to everyone, is that we are doing zero  
20 power tests with the new seven vein impellers fitted  
21 into that particular unit, with the primary heat  
22 transport circuit fully instrumented to show to  
23 ourselves whether we have cured the problem. So that's  
24 what is going on at the moment.

25 Q. Has containment leakage been another

1 problem with the nuclear facilities, Mr. Daly?

2 MR. DALY: A. Perhaps Mr. King can add  
3 to this.

4 I believe Mr. King mentioned earlier that  
5 Bruce "A" was just slightly below its target and we  
6 would like it further below its target, and as part of  
7 the vacuum building inspection work that we carry out,  
8 checks and so on are made of containment.

9 Perhaps Mr. King would like to add to  
10 that.

11 Bruce "A", it's slightly better in that  
12 the target level is the one where we are applying most  
13 effort at the moment.

14 MR. KING: A. I am not exactly sure  
15 what you mean is a problem. Maybe I should explain  
16 containment leakage, what the subject is about.

17 There is a requirement, there is an  
18 assumption that we make in the safety analysis that the  
19 containment structure has a certain degree of  
20 leak-tightness. There are penetrations throughout the  
21 containment structure and it's concrete and there is  
22 small pathways in large structures where they have a  
23 number of penetrations.

24 Now, you have to make sure that these  
25 passages are small enough such that it doesn't

1 invalidate your safety analysis. So in the safety  
2 analysis we would assume typically that either 1 or 2  
3 per cent of the internal volume per hour at the design  
4 pressure, if inside the containment was at the design  
5 pressure, that that's the leakage rate, and we would do  
6 the safety analysis assuming that. And if there was a  
7 source of radionuclides inside the containment and  
8 there was a certain driving force, we would calculate  
9 how much got out and compare that to the AECB  
10 regulatory limits to see if we meet them.

11 So what we do then in operation is to  
12 test containment regularly, to make sure that that  
13 leakage rate that we have assumed in the safety  
14 analysis has not been exceeded, and if it is exceeded  
15 then we generally have to go around and try to find the  
16 sources of the leaks and repair them.

17 Q. At Bruce "A" in 1987 you found  
18 leakage; is that right?

19 A. I don't have on the top of my head  
20 complete records of that. If you want to direct me to  
21 something...

22 Q. Sure, I can do that. Page 12 of our  
23 interrogatory package, please.

24 You can see from the previous page that  
25 this is AECB staff review of Bruce "A" for 1987, and

1 under the heading 3.2.1, Containment Testing.

2 As you say, all units...

3 In compliance with a licence  
4 condition, all units at Bruce nuclear  
5 generating station "A" were shut down in  
6 May to conduct an in-service test of the  
7 containment structure and the vacuum  
8 building. These tests revealed that  
9 leakage from the containment boundary  
10 could exceed that assumed in the safety  
11 analysis. Ontario Hydro was committed to  
12 install modifications to alleviate this  
13 problem by 1990. In the meantime,  
14 enhanced maintenance activity has reduced  
15 the leakage rate.

16 And then if we turn ahead, please. The  
17 next page of my exhibit is the cover page from the  
18 staff review for Bruce "A" for 1989. And the next  
19 page, page 14 of the package, under Station  
20 Performance, under the sub heading All Units, it says:

21 Station outage for containment and  
22 vacuum building testing modifications.

23 Those are the modifications that you  
24 identified the need for the previous year, I assume.  
25 Is that right, Mr. King?



1                   A. I am having a little -- I can only  
2     assume that the vacuum building outage occurred around  
3     Christmastime. Perhaps Mr. Daly can help me here. But  
4     you are referring -- no, sorry I take that back.

5                   Q. It says December 5th to --

6                   A. It's two different... It's 1988 and  
7     1990, so it's two years apart.

8     [4:50 p.m.]

9                   There is a requirement to take the vacuum  
10    building out for testing every ten years.

11                  Q. When you did the modifications on the  
12    vacuum structure, that would have been a common mode  
13    outage for the units? When the vacuum structure goes  
14    down all the units go down; is that right?

15                  A. That's correct.

16                  Q. Great. That is the point I was  
17    after. Thank you.

18                  Back to Exhibit No. 647, please, pages 10  
19    and 11. This is an article from The Economist. It  
20    starts at the bottom right-hand corner of page 10 of my  
21    exhibit, Nuclear Safety: Heat Treatment.

22                  The article talks about the problem of  
23    embrittlement, which I understand is a problem caused  
24    in the metallic components of the reactor due to  
25    neutron bombardment over a number of years.

1       Apparently, the metal gets brittle, and the problem is  
2       that emergency cooling could cause the containment  
3       systems to crack and lead to a loss of coolant, a  
4       meltdown, and an explosion.

5                       Is that the problem, Mr. King, in  
6       essence?

7                       A. I believe they are referring to  
8       pressurized water reactors with pressure vessels. It  
9       is not the situation with CANDU reactors; the ones they  
10      are talking about in this article.

11                      Q. Mr. Penn, you need not turn this up  
12      unless you want to, but you agreed with Mr. Bullock  
13      while he was questioning you that neutron bombardment  
14      of the pressure vessel was not a problem for CANDUs.  
15      However, a little bit later you testified that the  
16      metallurgical condition of the calandria vessel was a  
17      concern in terms of perhaps a life-limiting factor for  
18      nuclear reactors.

19                      The metallurgical condition of the  
20      calandria vessel, is that an embrittlement problem?

21                      MR. PENN: A. Well, subject to check  
22      whether -- how you have paraphrased what I actually  
23      said.

24                      Q. Well, we could go to it if that would  
25      be easier.

1 A. Well, it might be.

2 Q. That is transcript Volume 128, if you  
3 could turn to page 22415?

4 A. Yes?

5 Q. I think in the third line - I am just  
6 going to turn it up myself - you said:

7 The other key point. Which is the  
8 basis for the 40-year life at the  
9 present --

10 THE CHAIRMAN: I'm sorry, what line are  
11 we at?

12 MR. MONDROW: The third line.

13 Q. The other key point, which is the  
14 basis for the 40-year life at the present  
15 moment is the question of the  
16 metallurgical condition of the calandria  
17 vessel, and we just aren't [sure] at a  
18 point in time where we can make that  
19 decision yet.

20 MR. PENN: A. I didn't say "sure". I  
21 just said:

22 We just aren't at a point in time  
23 where we can make that decision yet.

24 Q. I stand corrected. My question,  
25 though, the metallurgical condition of the calandria

1 vessel, is that akin to the embrittlement problem that  
2 Mr. King just told us about?

3 A. Well, when you irradiate metals with  
4 neutrons - and it depends, of course, upon the energy  
5 of the neutrons involved - you can -- different rates  
6 change the metallurgical structure of the material, and  
7 experiments have been done on this sort of thing at  
8 Chalk River for, to my knowledge, more than 20 years.

9 And as Mr. King said, the situation in  
10 the pressure vessel of pressurized water reactors given  
11 the flats, nature of the flats in pressurized heavy  
12 water reactors is different.

13 Here I was offering my judgment, and the  
14 subject of the cross-examination was whether -- and, of  
15 course, Mr. Bullock was trying to gain my agreement  
16 that it was timely to extend the life of nuclear  
17 plants, and I was indicating that we aren't quite at  
18 that point, in my view. And eventually we came up with  
19 about year 30 that we would be able to be absolutely  
20 sure about that issue.

21 Q. The metallurgical condition, though,  
22 is this concern for neutron bombardment of metallic  
23 components, is that right, at 40 years?

24 A. It is a personal judgment of mine  
25 that this is an issue that should be looked at

1 carefully before the life of our plants are extended.

2 MR. KING: A. If I could add something,  
3 in the pressure waterized water reactor situation, my  
4 understanding of the concern is that the neutron  
5 bombardment and embrittlement changes the anneal  
6 ductility temperature of it such that when you inject  
7 emergency or cooling water, which is cooler water, then  
8 it can cause a thermal shock to that vessel and hence  
9 cause it to rupture, and what started out to be as a  
10 minor loss of coolant accident can become a very large  
11 loss of coolant accident.

12 As I say, that is my understanding of the  
13 situation.

14 With respect to the calandria vessel, it  
15 is quite a bit different. We don't inject any  
16 emergency core coolant into the calandria vessel at  
17 all, it is all injected into the heat transport system,  
18 and the places where that water is injected in the heat  
19 transport system piping is at a great distance from the  
20 core and is not subject to neutron bombardment.

21 MR. PENN: A. This all comes back to the  
22 issue, Mr. Chairman, that I tried in my introductory  
23 evidence to comment on, that in light water reactors  
24 the moderator and the coolant system are as one. In  
25 heavy water reactors they are two separate systems.

1                   So in light water reactors when you  
2           activate emergency coolant injection you are, as Mr.  
3           King said, directly affecting the vessel itself with  
4           the cooler water.

5                   Q. Mr. Penn, when you inject emergency  
6           cooling water into a CANDU that cooling water runs  
7           through the pressure tubes; is that right or is that  
8           wrong?

9                   A. Yes, it does.

10                  Q. And the pressure tubes are metallic  
11           and they have metallic welds at the ends; is that  
12           correct?

13                  A. Well, they have rolled joints into  
14           end fittings. These aren't welds; they are rolled into  
15           place.

16                  Q. They are metallic?

17                  A. Well, you have got a tube here  
18           (indicating) and you roll on the end fitting.

19                  Q. And there is no concern with  
20           embrittlement of that end fitting component?

21                  A. Not that I am aware of. That doesn't  
22           mean to say there couldn't be in the future.

23                  MR. MONDROW: Okay. Thank you.

24                  Mr. Chairman, I am going to turn to  
25           another area. Perhaps this would be an appropriate



1 place to stop for the day.

2 THE CHAIRMAN: All right. I will remind  
3 myself and others that we are not sitting tomorrow, but  
4 we will be sitting Thursday at ten o'clock.

5 THE REGISTRAR: Please come to order.  
6 This hearing will adjourn until ten o'clock Thursday  
7 morning next.

8 ---Whereupon the hearing was adjourned at 4:58 p.m.  
9 to be reconvened on Thursday, April 30, 1992, at  
10 10:00 a.m.

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